Factory
MANAGEMENT AND MAINTENANCE

Vol. 94, No. 5 — MAY, 1936

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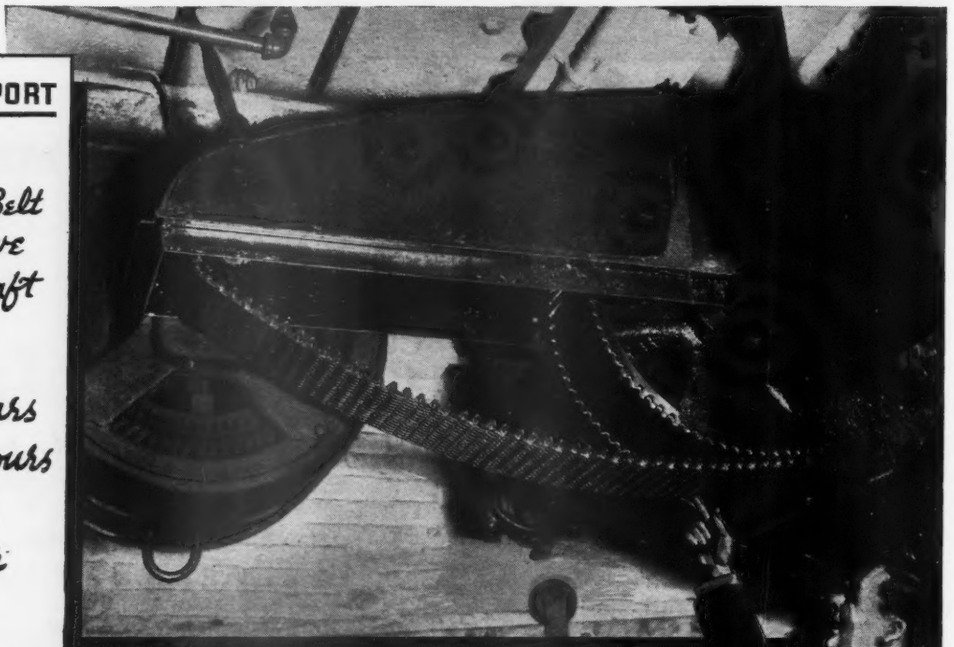
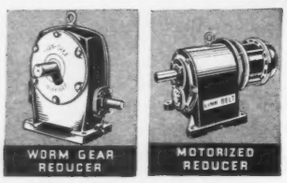
MAINTENANCE REPORT

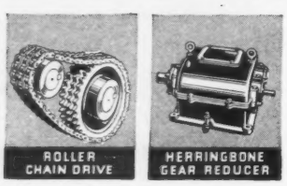
Date: 3/2/36
Item: 40 H.P. Link-Belt Silent Chain Drive
Location: Line Shaft Drive
Installed: 1906
Life to date: 30 years
Service: 78,000 hours
Condition: Fair
Remarks: Order New Chain for reserve

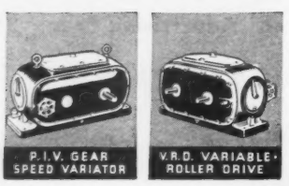


So, after 30 years,
THEY ORDERED A NEW LINK-BELT SILENT CHAIN *for reserve!*

Other Types of LINK-BELT POSITIVE DRIVES







● Installed in 1906, this 40 H. P. Link-Belt Silent Chain Drive has been running 50 hours per week for thirty years—78,000 hours of actual service! An inspection revealed indications of wear, so a new Link-Belt Silent Chain was ordered—*just to have one on hand when replacement eventually became necessary.*

With a sustained efficiency of 98.2%, and a service life measured not in years but in decades, Link-Belt Silent Chain Drive economy and efficiency cannot be approached by other methods of power transmission.

Drives carried in stock—½ to 60 H. P.—by distributors throughout the country. Larger horse powers supplied from the factory on short notice. Send for catalog. Address Link-Belt Company, Indianapolis, Chicago, Philadelphia, Atlanta, San Francisco, Toronto. Offices in Principal Cities.

5667

LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

CONTINUOUS SERVICE.. *not just for years.. but Decades!*

Factory
MANAGEMENT AND MAINTENANCE

L. C. MORROW
Editor

Jonah Can't Swallow the Whale

UNDER WPA direction a study of technological causes of unemployment is being carried on. The objective is a government policy that will result in a permanent cure for unemployment.

Re-emphasis on this WPA project is coincident with the President's Baltimore Youth speech and the A. F. of L. prediction that shorter hours and higher wages are necessary at once.

It is clear that the New Deal minds still consider that the full responsibility for unemployment belongs to industry.

But the Government's own statistics of maximum employment by industry show otherwise. They show that the manufacturing industries, which the average individual thinks of as "industry," employed at the peak of their activity a maximum of 8,800,000 workers. They now employ 7,200,000; are therefore responsible for only 1,600,000 unemployed.

The government's statistics show also that industry as a whole, which includes the "mechanical industries" as well as the "manufacturing industries," employed as a maximum 14,100,000. The mechanical industries include the building and miscellaneous trades.

If industry is responsible for idleness of the 12,000,000 that the government claims are unemployed, the inference must be that it now employs only 2,100,000. Ridiculous, of course—the manufacturing industries alone are employing 7,200,000.

The manufacturing industries at the peak employed approximately one-fifth of the gainful workers. So they cannot be responsible for more than one-fifth of the 12,000,000 idle, or 2,400,000. This leaves 9,600,000 that other sources of employment should be blamed for.

Those sources are: Agriculture (10,500,000 workers in 1930); mining, lumber, and fishing (1,200,000 workers in 1930); mechanical industries (5,300,000 workers in 1930); distribution and service (23,000,000 workers in 1930). Industry obviously has actually re-absorbed more than an average proportion of the reemployed workers.

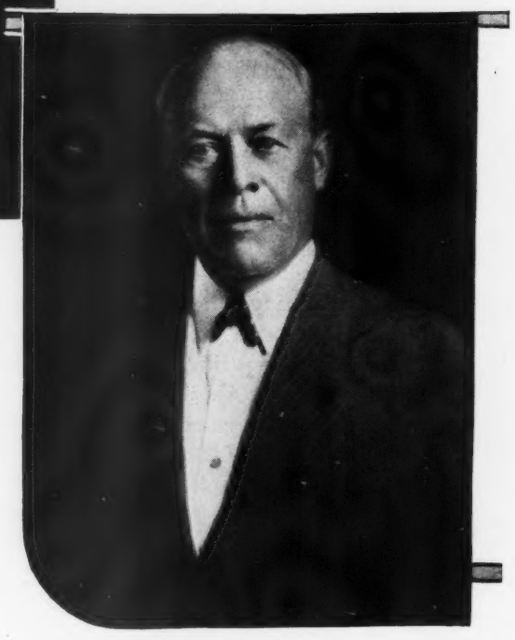
It is time for a lot of loose thinking to end. The only way for each individual to increase his wealth is for the nation to increase its wealth. We have found time and again that wealth cannot be distributed in advance of its production.

Yes, it is the same old answer. It is the same because it is the only one. Lift from industry financial burdens and legislative uncertainties. Then industry can produce at costs low enough to bring about an extent of distribution and demand that will result in volume large enough to cause migration of workers from agriculture and the other sources of unemployment into industry.

More

DURING the past few years abnormal conditions have brought problems to industry unlike any within the experience of most executives. Moreover, so many theories have been advanced that fundamental types of thinking have sometimes been obscured. All of which does not mean that the basic force of fundamentals has in any way been suspended.

For some time we were all subjected to an idea that it would be pretty fine for everybody if the productive capacity of the nation were frozen at a point certainly no greater than the then capacity, and preferably a long way below that capacity. In some industries it was seriously urged that any manufacturer who wanted to add new equipment would have to show that it would not be



GENERAL OTTO H. FALK
Chairman
Allis-Chalmers Manufacturing Company
Milwaukee

Machines More Jobs

used to increase output or to decrease employment — which sounds like an economy of scarcity rather than an economy of plenty.

Simplicity Itself

It seems hardly necessary to argue in favor of an economy of plenty. Consider the theory in its simplest form, where it ties into my hobby. My especial interest outside my business is my farm, and my particular focus on the farm is my herd of milch goats. These goats yield milk that is of particular value to certain types of tricky digestion most frequently encountered among infants and some few adults in ill health. Because I do not want to be involved in this goat dairying on a commercial scale, I refuse to sell the milk. We use just as much of it as we wish, and the surplus is available to those who need it through hospitals, baby specialists, and so forth.

All right, it must be rather plain that the more of this goat's milk we make available to the public the better off the public is. Because we do not charge for it does not mean it costs nothing; it merely means that I set aside x dollars per year to pay the expenses of the goats, and give away all the surplus.

Now suppose someone develops a strain of goats that yield double the gallonage of milk on the same feeding; or that someone produces a machine that enables me, miraculously enough, to get the same volume of milk with half the labor around the goat barn and dairy. Since I am not spending on the goats any more than I can afford, I still continue to budget x dollars to this enterprise. The production of milk is greatly increased. Our surplus for giving away is thereby even more increased proportionately. And the people around Milwaukee who would profit by obtaining goat's milk will certainly be the gainers.

The outlines of this working-out are simpler of comprehension because, as it happens, there is no sizeable commercial source of goat's milk hereabouts, so we should not be hurting anybody's business by our increased production, and it can be seen as net gain to all concerned.

Now let us leap mentally into town, into the Allis-Chalmers tractor plant. It was built just prior to the depression, to make 40 tractors per day of one kind. We anticipated that some time in the future we might increase this business, so we allowed for expansion by leaving sufficient room in various machine divisions to install extra units when and where necessary. During the depression an entirely new model tractor was designed and put into production, and most of the work in connection with it is being done in this same plant. Production of this new model has been stepped up from time to time until now 80 units are made each day. This necessitated the installation of a few pieces of new equipment and the addition of men along the assembly lines which, when originally laid out, allowed for this expansion in an orderly fashion.

Of course we did not always keep this plant filled to capacity during the worst years, but gradually, as farmers began regaining a little of their purchasing power and as construction began to stir from its long sleep, demand increased and we sold more tractors. We increased our output, here a little, there a little, gradually working it up to its present volume.

Planned Expansion

We did not at any time reach a stage to which in retrospect it is possible to point and state dramatically that "right there was the turning point" where, unless we had done "so and so," we could not have increased production to meet orders. We reached no such crisis because we had planned in a general way for greater eventual production and because we had been improving the plant layout and equipment whenever we had seen an opportunity to increase production and better the quality of work.

For example, new equipment was

(Continued on advertising page 37)

Out of long experience with raising milch goats and building tractors, General Falk comes to this conclusion: "The more goods that are turned out and distributed to the general public, the higher our scale of living and the better off our people." Every page of industrial history offers new proof that the machine makes more jobs for more people

Factory Paper

MASTER PLATES for the preparation of factory paper are kept on file in the production planning department, are ready for use over and over again as repeat orders come through. Here the clerk is removing one of the large plates from which bills of material for assembly orders are printed

★

W. T. GUNDERSON
Supervisor of Planning, Production and Material Control
Addressograph-Multigraph Company
Cleveland

FOUR OF THE FORMS that comprise paperwork for parts orders for stock. Three of them are printed from the master title plate, the other from the operations plate, kept on file in the production planning department. These permanent plates are available for instant re-use whenever it becomes necessary to prepare factory paper for repeat orders. Not shown are three 3x5 cards—one for the finished parts stockroom, one for the time study division, the third for the billing department; another 3x5 card that is used when necessary as a tracer; and an identification tag that is attached to the material. All five are printed from the title plate

OUR PRODUCTION PROBLEM is similar to that of thousands of other factories. We make over 100 basic models of equipment, and over 100 different attachments that may be added to the basic machines to widen the scope of their utility.

Naturally, in a manufacturing operation of this magnitude, a great deal of record keeping and transmittal of information are essential to the proper control of production, and it is only logical for us to use our own equipment

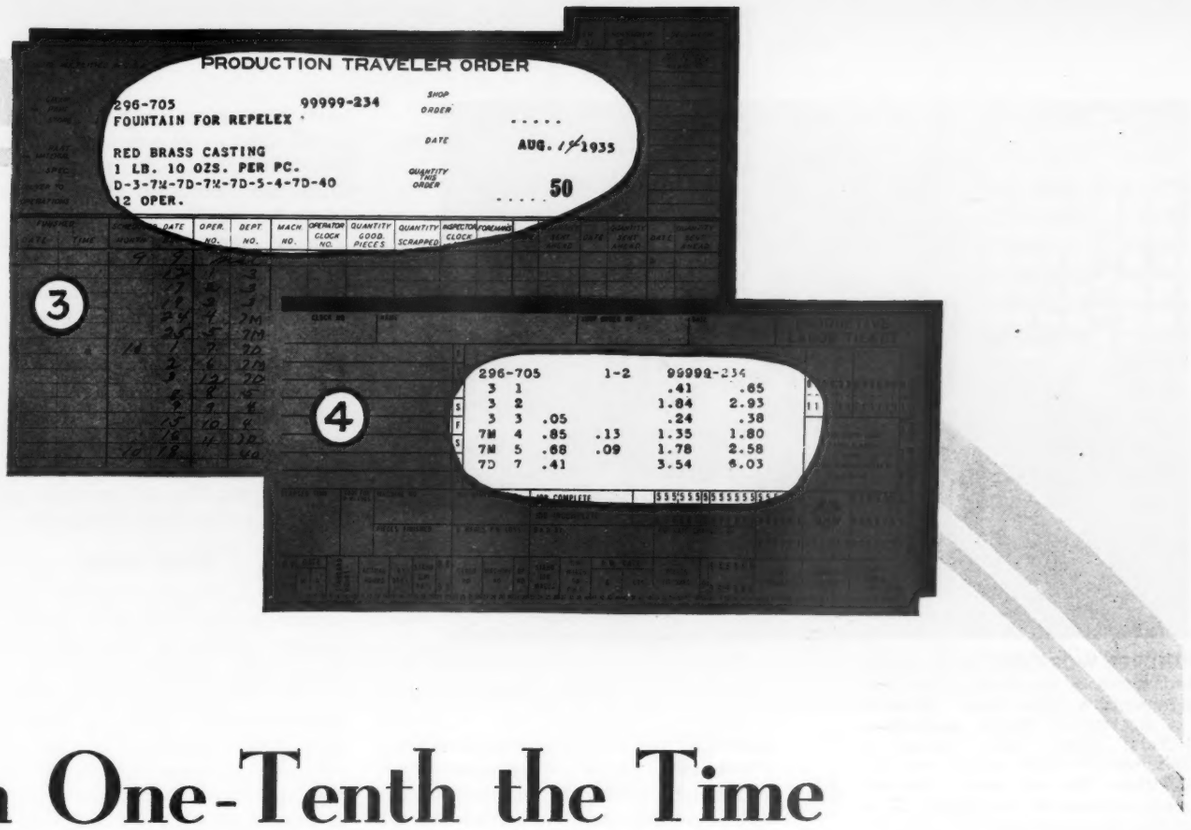
Orders going through the factory may be divided into three general classes:

1. Parts orders for stock.
2. Regular assembly orders.
3. Special orders for dies, tools, or special machines and attachments for specific customers.

Parts Orders for Stock

Our centralized stockroom carries at least 35,000 active parts for new machines and a number of somewhat inactive replacement parts for older machines. Most of these parts are ready for use in assembling completed machines, or in filling special orders.

In the stores record department is kept a file of stores ledger cards (Figure 1). When the card for any part shows that the stock has



in One-Tenth the Time

reached a predetermined minimum, the storekeeper sends the card, together with a request for a shop order, to the production planning department.

A clerk removes the corresponding title plate from the file in this department, and prepares four cards and an envelope to hold the cards. The first is a tracer card used by the stock clerk in case it becomes necessary to expedite the production of the part. The second card (Figure 2) is used as a requisition on the raw materials storeroom. The third card is an identification tag to be attached to the material as it is transferred from one department to another and finally to stock.

Fourth card (Figure 3) is the production traveler order that travels with the material. The production department clerk enters on this card the sequence of manufacturing operations and the date each operation is due to be completed. This is copied from a schedule card on file in the production office.

The title plate used to imprint envelope and four cards as described is embossed with the part number, name of part, material, specification, departments that work on the part in sequence, and total number of operations. In addition, date of order is printed on material requisition card, identification tag, and traveler order by means of an auxiliary plate. Quantity is printed at the same time by a numbering device.

After making these forms, the production office clerk uses the operations plate, which is filed next to the title plate, to fill out the productive labor tickets (Figure 4), one of which is issued to each employee who works on the job. Each labor ticket has room for listing six operations. Experience has shown that approximately one and one-half times as many labor tickets should be made as there are operations to be performed. Thus, if there are twelve operations on a part, eighteen tickets are made out.

The labor ticket shows, reading across the top line, part number (296-705, in this case), number of plate (as 1 of 2, because there are more than six operations), order number (99999), and suborder number (234).

Five columns on the labor ticket show department, operation number, set-up price, tear-down price, price per 100, standard time.

The entire envelope of cards and the tag is sent to the shop, and in each department the work is assigned to a particular machine and employee. Entries of assignment are shown on back of labor ticket.

At each factory desk there is a hand-operated Addressograph. As a job is assigned to an employee, his name and number are imprinted on the labor ticket from his plate, and his starting time is stamped by inserting the card in the electric time clock on the clerk's desk. The clerk circles the operation the employee is to perform.

This simple routine saves both the time of the workmen and the time of those who check and transcribe the information on the time tickets. In filling out time tickets by hand, with part number, operation number, order number, rate, and employee's number, there are at least five chances for error in copying, plus a greater expenditure of the clerk's time in writing, and the workman's time in waiting. In other words, with our 7,500 time tickets a week we should have 37,500 chances for error. With the machine method we make less than one-tenth of 1 per cent of these possible errors. By actual check this method is at least ten times more accurate, and from ten to fifty times faster, than hand methods.

You have noted that when the cards for stock orders went to the production office the descriptive title plate and the operations plate were already in the file. Let us see how they got there.

A blueprint of every new part is

ONE HUNDRED WORKMEN in the special parts and toolroom department get their job assignments at this desk. Schedule board in background holds productive-labor tickets; pigeon holes indexed by workman's number hold tickets for jobs assigned. One file of plates contains names and numbers of workmen. Two others contain operation and title plates for special jobs

made by the engineering department. The production department layout engineers establish the sequence of operations and tooling for making the part and enter them on a parts route sheet. The parts route sheet is a one-time record, and is not embossed as a whole on plates, but the previously described title and operations plates are embossed in accordance with information entered on it. As changes in parts or manufacturing procedures are made, the clerks of the production office change the plates.

Assembly Orders

The same type of traveler order as issued for the manufacture of parts is issued for an assembly order, and in addition the bills of material are printed. The plates used for this purpose have a much larger printing surface than the previously mentioned plates, and are printed on plain 8x11 paper.

The index sheet (Figure 5) lists the separate operations required to assemble the complete machine from previously completed sub-assemblies, number of plates on file, and number of sheets required to produce the bill of material (Figure 6) on each operation. Order number and quantity required are printed on the assembly bill of material by numbering devices in the bed of the machine.

Should the assembly order deplete stock of parts on hand, an order for parts for stock must be issued. If insufficient parts are available to fill the assembly order, the stockroom attendant furnishes all the specified parts he has on hand and requests tracing clerk to rush the parts in process of manufacture.

Certain assembly operations such as adjustments and testing do not require plates since no parts are required. The only forms made out for these operations are the labor tickets.

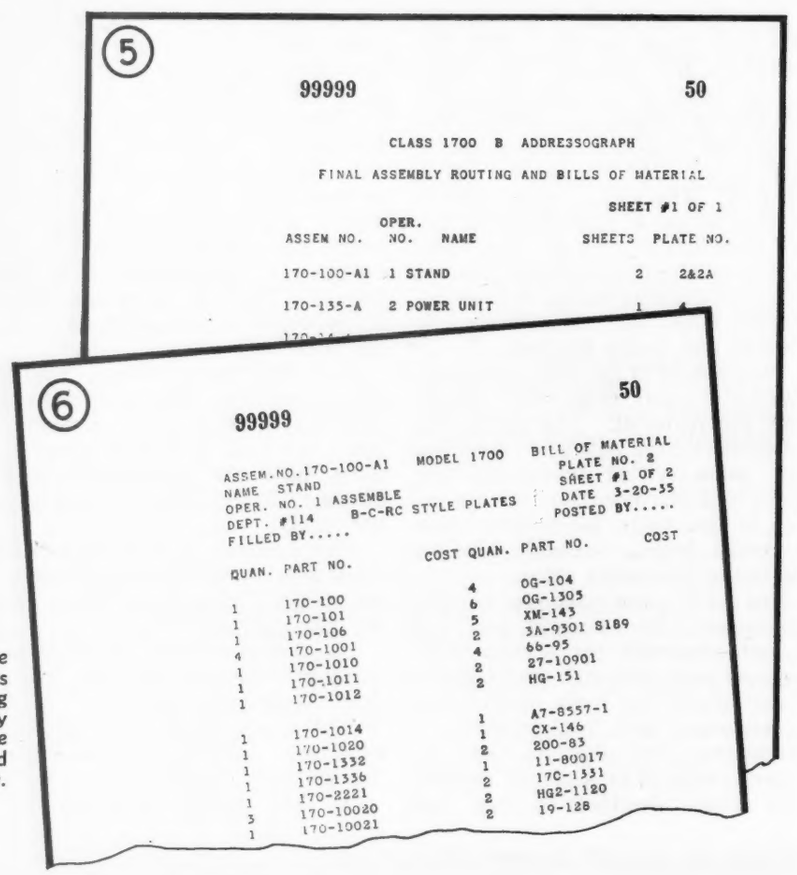
Assembly bills of material for variable parts such as electric motors for different line voltages are printed on pink paper from a similar plate.

Special Orders

Under special orders are included orders for dies and tools, or for particular machines and attachments for specific customers.

The order in this case shows customer's name, kind of attachment, and order number. A descriptive plate is embossed and used to fill in the necessary shop order forms. It is then sent with these forms to the factory desk. It is used at the clerk's desk in the factory, where labor tickets are made out as needed, instead of being made out in advance in the central office as in orders for parts for stock.

(Continued on advertising page 40)



(5)

99999 50

CLASS 1700 B ADDRESSOGRAPH

FINAL ASSEMBLY ROUTING AND BILLS OF MATERIAL

SHEET #1 OF 1

ASSEM NO.	OPER. NO.	NAME	SHEETS	PLATE NO.
170-100-A1	1	STAND	2	2&2A
170-135-A	2	POWER UNIT	1	

(6)

99999 50

ASSEM. NO. 170-100-A1 MODEL 1700 BILL OF MATERIAL
NAME STAND PLATE NO. 2
OPER. NO. 1 ASSEMBLE SHEET #1 OF 2
DEPT. #114 B-C-RC STYLE PLATES DATE 3-20-35
FILLED BY..... POSTED BY.....

QUAN.	PART NO.	COST QUAN.	PART NO.	COST
1	170-100	4	OG-104	
1	170-101	6	OG-1305	
1	170-106	5	XM-143	
4	170-1001	2	3A-9301 S189	
1	170-1010	4	66-95	
1	170-1011	2	27-10901	
1	170-1012	2	HG-151	
1	170-1014	1	A7-8557-1	
1	170-1020	1	CX-146	
1	170-1332	2	200-83	
1	170-1336	1	11-80017	
1	170-2221	2	17C-1331	
3	170-10020	2	HG2-1120	
1	170-10021	2	19-128	

FOR REGULAR ASSEMBLY orders, these two 8x11 forms are printed from plates kept permanently on file. Outstanding advantage of this method of making factory paper is that all parts and materials are centrally controlled. Plates are embossed only in the production planning office. Only there can changes be made

We Set 76% of Our Rates from Master Studies

Less wear and tear on time study men is one big advantage of this scientific method of setting standards. They don't have to spend their time on routine studies, can concentrate on the jobs that offer the greatest return

J. E. BLACK
Production Engineer
Monroe Calculating Machine Company, Inc.
Orange, N. J.

THE MOST COMMON use of time study is for setting the time required to perform a task and making this time the basis for wage payment. Following logically from this is the control of costs and production. Time study should be regarded as a tool of modern management, and as such has uses other than for ordinary rate setting and improvement of methods.

The first step to consider is the setting of standards from tabulated data or formulas. The term "master study" will be used for the tabulated data or formulas with a description of conditions and limitations from which standards are set for a given class of work. The term "standard" will be considered as meaning pieces per hour.

This method of setting standards is of particular importance in businesses that handle production quantities, but not mass production quantities, of a large number of items with relatively short operations of a similar nature, or in shops handling job work where the operations are of short duration.

We have used this method successfully on one class of work since 1926. Its scope has been increased until we now set 76 per cent of standards on all machine operations in this way.

Everyone Is Satisfied

Another advantage of setting standards from master studies is that uniformity is obtained. This is important. For example, in one case there was a wide variation in the standards for riveting small studs. This caused a lot of dissatisfaction. Operators complained when they had to do a job with a high standard, and when an operator had an easy job it caused dissatisfaction among the others. The logical criticism is that this was the result of poor time study. Perhaps it was. I have yet to see a plant where similar situations do not exist. However, since applying standards from master studies the average time allowed is actually less than it was when each job was timed, but there is practically no dissatisfaction on this class of work and all the operators are making fair earnings.

From the standpoint of the time study department, master studies have the advantage of reducing the work necessary for setting the greater part of the standards. This means that the department can be operated with fewer time study men, and these men do not have to spend time on what might be considered as routine studies. Their time is released for the unusual and the long jobs—those jobs that usually offer the greatest return.

The technique in developing the master studies begins with a review of all available time studies. First investigate the range and see if there is any apparent reason for the variation of standards. This requires technical knowledge of the work. A good way to go about this is to make a series of charts, plotting time against the different variables that might affect the times. Abnormally high or low values should be carefully examined to see whether there is a time study error or whether reason justifies the differences.

Time taken for an operation can usually be divided into fixed and variable elements. Fixed elements are such items as starting a strip of stock in a die, inserting an arbor of work in a machine, or picking up a handful of work. Elements of this sort have times that are constant for a work unit and are usually spread out over a number of pieces. In many cases they are not true constants, but are constant only for a given set of conditions. For example, the time to start a strip of stock in a die depends upon width of strip.

Variable elements in a standard are the times that depend upon the number of work items. Such an element might be the number of holes in a drill-grinding operation or gear-cutting operation. These elements may likewise depend upon certain variables. It will be found that some operations lend themselves to an almost complete mathematical analysis, while for others flat times for any piece are determined empirically. There is also the middle ground, where, from collected data, empirical relations are found. After the data have been collected and tabulated and relations determined, it is often necessary to make additional time studies to fill in gaps in the information or to verify assumed relations.

Cutting Gears, for Example

For the first case, we will consider the cutting of gears on a hobbing machine. In this work, one or more gears are fastened on an arbor and placed in the machine. The machine (or feed) is started. The hob approaches the work and starts cutting. As the feed continues, the hob enters the work until it is cutting full depth and feeds across until it has completed the cut, at which time the machine automatically stops. The operator then removes the work. During the cut the operator prepares the next arbor of work and does the necessary gaging. In actual practice, the operator runs a battery of machines. Factors affecting the time for one arbor are:

t = total cutting time in seconds
L = length of cut
K = distance hob travels from start of cut until it is cutting full depth. This is a constant for any given hob diameter and depth of cut. In practice it is a function of the pitch of the gear being cut

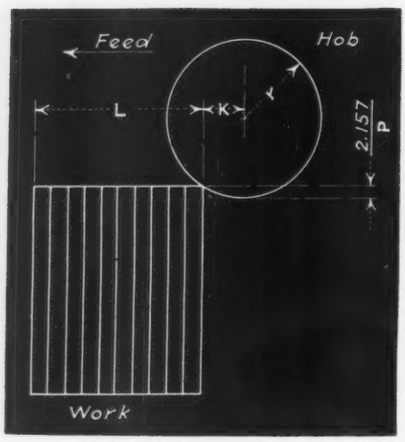


FIGURE 1

N = number of teeth in gear
f = feed per revolution of gear
R = r.p.m. of hob
C = distance allowed for hob to approach work. This is a constant
P = pitch number of gears
r = radius of hob
G = number of gears on an arbor.

Referring to Figure 1,

$$K = \sqrt{r^2 - \left(r - \frac{2.157}{P}\right)^2}$$

for standard B&S teeth. If we should use a 1⅛-in. diameter, 48-pitch hob, K would be equal to 0.268. This does not take into consideration the angle at which the hob is set, which is about 2 deg. for 48- and 32-pitch hobs and is neglected. Sufficient is allowed for the approach to take care of this. With multiple-thread hobs, coarser pitches, or when hobbing helical gears, it would have to be considered. The length of cut, L, is the total thickness of the gears on the arbor if they are flat; if they are not, it is the total distance between the outside faces of the end gears. The total distance the hob must travel then is $L + K + C$. The time for one revolution of the hob in seconds is $60/R$, and the hob must make N revolutions for one revolution of the gear. Time for one revolution of the gear is then $60N/R$. During this time the hob feeds a distance f, the feed per revolution of the gear. If we divide f into the total distance the hob must travel, we have the total revolutions of the gear; that is, $\frac{(L + K + C)}{f}$. If we multiply this by the time per revolution, we have the total cutting time in seconds; that is, $t = \frac{(L + K + C)\ (60).N}{fR}$. This is the variable time element.

So far time study has not entered into it. We must now consider the operator factors, which are determined by time study. These are, with allowed values, as follows: (1) Walk to machine = 3 sec.; (2) place arbor between centers, advance hob to work, and engage feed = 12 sec.; (3) stop machine, run hob back, and remove arbor from machine = 6 sec.; (4) gage work = 2 sec. These total 23 seconds per arbor of gears. This is the fixed time element. To this and the cutting time we add the allowances. Assume that these are 5 per cent personal, 5 per cent materials handling, 15 per cent lost production (or machine interference) for running a number of machines, and 12 per cent speed allowance. This last might be considered as an allowance for bonus earnings and is tied up to a certain extent with the incentive plan used. These allowances total 40 per cent. The total production standard in pieces per hour will be equal to the total operator's time, plus cutting time, plus allowance, divided into 3,600 (seconds in one hour), and multiplied by the number of gears on an arbor, and the number of machines run. If an operator runs three machines,

$$\text{Standard} = \frac{3G}{1.40}\left[\frac{3{,}600}{23 + \frac{(L + K + C)\,(N)60}{fR}}\right]$$

Let $C = 0.040$ in., $R = 580$ r.p.m., and $f = 0.025$ in. per revolution, which gives

$$\text{Standard} = \frac{1{,}855G}{5.55N(L + K + 0.040)}$$

pieces per hour. With $K = 0.268$, as found above, for a 42-tooth, 48-pitch gear, with 10 pieces on an arbor, with a thickness of 0.125, the standard would be 262 pieces per hour. This is three times the machine standard.

We shall next consider a case less subject to mathematical analysis, where an empirical relation is found from collected data. A good example is blanking small parts from strip steel in dies with fixed stops. All strips are 8 ft. long. The family of curves in Figure 2 show allowed blanking time in seconds per piece versus the spacing of the blank in the strip for various widths of strip. The scale of spacing is reciprocal, as these curves were originally made out for pieces per strip. Pieces-per-strip is found in computing the standard, and the curves may be used either way. Let

s = spacing in inches
t = time for blanking per piece in decimal hours (from curves)
c = constant per strip in decimal hours from a table. This is also a function of the width of strip. It is the time for picking up a strip, applying lubricant, starting it in the die, and discarding the scrap. The value of c varies from 0.00306 to 0.00431 for widths up to 5 inches.

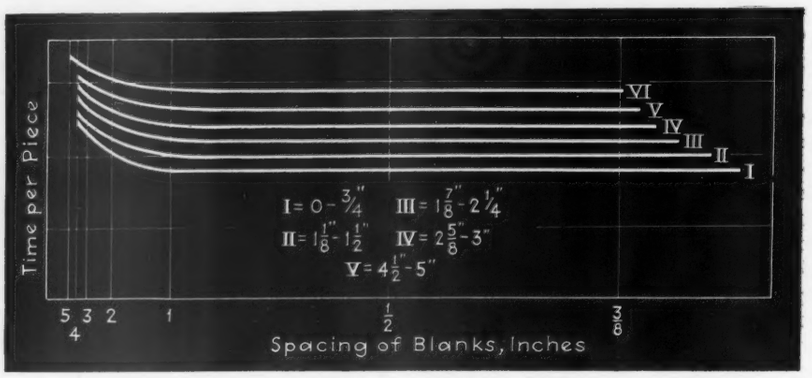
If allowances total 20 per cent,

$$\text{Standard} = \left(\frac{1}{\frac{c}{\frac{96}{s}} + t}\right)\frac{1}{1.2} = \frac{80}{cs + 96t}$$

In practice, a table was made up from the above formula, showing standard in pieces per hour for different spacing and blanking widths of strip. Values were interpolated for blanking time per piece for widths between the curves shown in Figure 2.

Space does not permit going into complete details of the development of master studies in the two examples given. It is not advisable to take values or formulas obtained in one plant and use them in another without further analysis. Formulas should always be modified to suit existing conditions. In using master studies, it is important that limiting conditions be carefully stated.

FIGURE 2



Penetrating the Skin of Industry

CAREY P. McCORD, M. D.
Medical Director
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Believe it or not, a story of occupational dermatitis without a single horrible detail, without a single harrowing exhibit! Yet a story, for all its readability, that may jolt you loose from your complacency, even get under your skin. It's the first of two articles by a leading authority on industrial skin diseases

RARE is the industry that does not provide for its workers at least one opportunity to acquire a trade dermatitis. From chocolate makers to chrome platers — from anchovy packers to automobile assemblers — from linoleum colorers to lithographers—from tree sprayers to type cleaners—these and a thousand more trades may furnish occasion for contact between the skin of the worker and irritant work materials.

. . . dermatoses prefer blondes

Averting an Epidemic

An enterprising young research engineer evolves a revolutionary plan for money-saving through the use of a rubber-coated fabric as a substitute for metal. All is ready for the transfer of the process from laboratory to plant. Suddenly most of the experimental workers develop a troublesome rash on their fingers, hands, and forearms. Something is wrong. The plant physician is summoned in, and in time the cause is discovered. The offending agent is di-orthotolylguanidin, a complex chemical used in traces as an accelerator in the curing of the rubber. A harmless substitute is found—the development of an extensive industrial epidemic has been averted.

A fair - haired youth, not realizing that his physical type is particularly susceptible to skin affections, counts himself fortunate when he obtains a job as a maker of insecticides. By chance he is assigned to the making of Dalmatian insect powder, which is nothing more than ground-up chrysanthemum buds. Within a week the soft skin within his elbows, under his arms, about his eyelids, and around his shoetops is inflamed and blistered. Seeking relief, he consults his physician, learns that his industrial dermatitis is due to the injurious effects of pyrethrum powder, another name for the pulverized buds.

A furrier is not satisfied with the natural color of his cheap furs, seeks to impart rich brown shades. He dips his skins into solutions of ursol, or quinon, a dye known to the chemist as para-phenylene diamine. This dye produces the desired effects on the fur, but soon the furrier finds that his skin is red and swollen and later blistered. He is in full possession of the well-known "furrier's dermatitis."

In the manufacture of felt hats, the fiber of the rabbit fur—rabbit fur being used more than any other kind—is far too smooth to "mat" to a compact fabric. Barbs are needed to interlock with barbs and other fibers. To create or loosen up the barbs on the animal fiber, a "carot" is used. This changes the fiber, as examined under the microscope, from the appearance of a section of smooth telephone wire to that of "barbed" wire. The most successful carot is mercury nitrate. Hatmakers, historically famous as sufferers from wood alcohol poisoning, including wood alcohol dermatitis—the wood alcohol being employed as a stiffener for felt—are now frequent sufferers from mercury poisoning, in which mercury dermatitis may be one manifestation.

By no means does any one industry pre-empt the damaging action of any one chemical. At least seventy-five industries use mercury.

In the manufacture of small arms ammunition, for example, it is necessary to implant at the base of each cartridge a small portion of mercury fulminate, or other high explosive, as the detonator of the powder. Commonly this job is done by hand, which leads to the implanting of traces of this mercury salt under the nails, and eventuates in localized mercury poisoning.

A Five-Way Split

Every steer has not one hide, but five—at least he has when the thick hide is split into five layers. To avoid jaggedness on the cut skin surface, the sharp blade of the knife is dusted with sumac powder. Hot and sweaty, each man in the splitting gang finds this powder dusted on his body. Fortunate is the hide-splitter who throughout his years of employment escapes sumac rash.

Every month carloads of copra, the dried meat of the coconut, are brought to the soap factory, preparatory to the expression of coconut oil employed in the manufacture of fine soaps. Prior to oil expression, the copra is ground, or shredded. Here the atmosphere is pervaded by fine copra dust. Wherever it settles on the skin of workmen, redness comes,

and itching, then discomfort and pain. This is the "copra itch."

Industry's ingenuity is finding in synthetics practical substitutes for the natural resins brought in from India, Africa, South America, and other remote corners of the world. Some of these synthetic resins are far superior to their natural predecessors in meeting industry's needs. But unfortunately some possess a full measure of the unwanted property of damaging the skin of whoever handles them. Natural resins in their waning use hand down to their successors the malignant curse of skin irritation.

. . . once a worker was observed cleaning his hands on a grindstone

Without extravagance or exaggeration, an almost endless recounting might here be made of industry's excitants of skin disorders — the industrial dermatoses. For the industrial hygienist these skin-harmful agents provide adventures, new frontiers for exploration, new opportunities for service to industry and its workers. For industrialists these same agents provide added costs of production, claims, suits, dissatisfaction. For exposed workers this myriad of industrially applied substances brings about pain and disability, discontent, lost time, doctors' bills, and sometimes the necessity for changed occupation. Eradication of these unwanted, disturbing factors in industry constitutes a small but troublesome part in the nation's business.

If all the materials of industry were listed, from those in "abbattoirs" to those in "zinc plating," the industrial hygienist might check off several thousand as possible sources of skin damage. The list would embrace many simple items like the lowly turpentine, as well as the more impressive, like hexamethylenetetramine—perhaps urisol to you. Fertile are coal-tar derivatives as producers of damaged skin.

What Happened in Ohio

Occupational dermatoses comprise more than one-half of the total number of occupational diseases. Ohio's experience is an example. During the past seven years 8,533 occupational disease claims received favorable action at the hands of the compensation board. Of this number, 5,855, or 69 per cent, represented skin affections. For every instance of such severity as to reach the status of a compensation claim, possibly as many as five others existed, but provoked little concern.

Some reason prompts the assertion that over this period Ohio's contribution to industrial waste through the skin-disease medium is nearer 25,000 than 5,855. Yearly less than 8 per cent of Ohio's physicians report any occupational diseases of any character. This at first glance might be interpreted to mean that very meager numbers of occupational diseases arise, but it is more nearly reasonable to believe that it reflects paucity of professional curiosity in exact diagnosis. Every year approximately 50 per cent of physicians in industrial states see occupational dermatoses, whether or not they recognize them as such. Nearly 15 per cent of all the skin lesions of adults are of occupational origin. In a few departments in some industries, all workers present skin diseases all the time. Let the person who would challenge this statement examine the hands of laborers in any tanyard using oak tanning methods with or without the extra irritant found in the sometimes-used quebracho. The hide of the worker's hand is tanned along with the hide of the steer.

With due regard for the demands of conservatism, some warrant appears to exist for fixing at close to 100,000 the nation's yearly industrial output of skin diseases.

Easy Victims

Fortunate is the worker in many trades who is black of hair, dark and oily of skin. Only a negro can withstand the skin hazards of a few extra-hazardous trades. The tow-headed, flaxen-haired, red-topped, or freckled-skinned worker falls an easy victim to the onslaught of cutaneous irritants. Freckles themselves provide no added susceptibility, but merely attest a type of skin readily influenced by external agencies. By no means is the brunet wholly immune to the ravages of skin-injuring substances. The very young, the aged, and the new worker, regardless of type, are ready prey for industry's skin diseases.

It is a bit disgusting to read that some workers acquire skin affection because they are too dirty, and astonishing that others suffer because they are too clean—but it is true. In the presence of an outbreak of skin disease a distraught factory manager may run his technical department from hell to breakfast getting chemical analyses and bacterial cultures, looking for some peculiar cause. Although technical investigation is not to be decried, the works manager is here advised that a very small hand lens held over the skin of the forearm of a worker will often reveal one of the salient causes of many a skin disaster. The grime of work, with its contained irritants, is forced into and sealed into the openings of the skin. An insulated skin protests this effrontery with inflammation.

Bathing in Benzine

Cleanliness of the skin is not to be condemned, but the means through which cleanliness is attained may defeat the worker's intentions. He who removes industry's oils, tars, paints, and greases by laving in a bucket of benzine, carbon tetrachloride, or naphtha is headed for the medical department. In some plants the end of the shift sees its well-intentioned workers in the washroom punishing the skin by scrubbing with alkali powders, abrasive mixtures, harsh soaps, turpentine, hydrocarbon solvents, or cutting compounds. Even a long-suffering skin will rebel against such indignities. Once a worker was observed cleaning his skin on a revolving grindstone.

Summer days are heydays for dermatoses. Profuse perspiration macerates the skin, flushes off the natural oily coating, and, becoming increasingly alkaline in its reaction, renders the skin vulnerable to the action of its enemies. Nearly half of the year's crop of impaired skins in industry grows during the three summer months. In some industries the summer lasts the year round—if you don't believe it, stand for half an hour at any time of the year alongside the charger of a glass batch.

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"A skin-afflicted worker blames his work materials," points out Dr. McCord in a second article scheduled for June. Many an employer, month in and month out delivers compensation checks to workers whose conditions in no degree have been produced by industry's processes

If the worker only knew

Would he be afraid of mechanization?

"Why, Sam, this mechanization business . . . is the only reason why you and I rolled to work this morning in this little old Cyclone Six"

"I SEE," said Sam, as he picked up Ed in his 1934 Cyclone, "that we got three new turret lathes yesterday. We keep buying machines and building machines—where's it all going to end?"

"So it's biting you now!" laughed Ed. "I expect it from those fellows who keep drawing charts without knowing the head from the tailstock, but not from a good mechanic like you."

"What's biting me, Ed?"

"Why the technocracy bug or whatever insect it is that makes a man believe that machines will ruin us all. We've had machines for a long time now and they haven't hurt us yet, have they?"

"We have unemployment, and you've got to admit that machines put men out of work. Take these new turret lathes for example. They're faster and more rigid than the old ones. They can easily turn out twice the work. And every year we're designing and building more efficient equipment ourselves."

"Sam, you've got your nose so close to the tool rest you can't take the long view of mechanization. Just suppose we scrapped all this machinery and passed a law not to build any more. How do you suppose you'd work and how would you live?"

"Nobody wants to do that, Ed. I'm not hankering to roll boulders up hill with someone cracking a whip over me. Handicraft is all right for artists but not for production. But we've got so much machinery now it seems we ought to keep it under control."

"If mechanization had a bad record, Sam, I'd agree; but just the opposite is true. I was reading the other day that between 1870 and 1930 the percentage of gainful workers rose from 32 to 40. Plenty of machinery was built during those years."

"It doesn't make sense, Ed. We make machines that take less manpower. That certainly throws men out of work, and yet you say that more men are working. What's the answer?"

"Simply that the use of machinery creates entire new industries that provide jobs for great numbers of workers, and that would never had been possible under the old methods. Take the automobile industry, for instance. Including bodies and parts, it accounts for close to half a million men. Electrical equipment, mechanical refrigerators, office machinery, and tire manufacture have all formed the basis of great enterprises that have grown up in the last few years. They've made work and created wealth in the form of new products which the workers enjoy."

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The series to date: 30-Hour Week; Townsend Plan; Labor Relations Law; Taxes; Mechanization. Each available in 3x5 pamphlet form for management to distribute to workers

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"But we've got to have the buying power to enjoy these products, Ed."

"True; and one of the best ways of increasing buying power is to lower costs. That means the use of better machinery. The lower costs get, the lower prices go, the more products are sold, the more have to be made, and the more people get jobs."

"That's fine, Ed, as long as everything is going right. We build bigger plants and better machines until all of a sudden we find we haven't enough money to buy their output. Then we come down with a crash as we did six years ago. It looks as though the more we mechanize the harder we fall when the boom ends. Something should be done to prevent all the hardships and misery these depressions cause."

"When you start on cause and effect of depressions, Sam, you're on a problem that the best minds haven't solved yet. But there's nothing to show that machines cause the trouble. In fact, many economists agree that the wide swings in business are financial rather than industrial. The speculator is the fellow who needs watching, not the engineer."

"Even so, Ed, haven't we gone far enough mechanically so we should put on some kind of control? Suppose we admit the engineer has outstripped the economist, can we ever hope to keep step with changes brought about by new inventions?"

"And who'll do the controlling, Sam? A political bureau or a group of industrialists with their own interests to protect? Who could have foreseen the development of electric light or electric power and controlled it intelligently. These things gave us greater comfort with less effort. There's no reason to think that we're at a stopping point now. Unhampered progress is the surest way to boost living standards for everyone.

"Why, Sam," as the latter slid into an empty space in the factory parking lot, "this mechanization business that's got you so worried is the only reason why you and I rolled to work this morning in this little old Cyclone Six of yours. How you'd holler if we all had to go back to the horse-and-buggy days!"

Laid Out

MY FIRST article showed how all production machinery was brought down from three upper floors to the ground floor, and how by subsequent rearrangement the layout was further improved. Gains were made in routing and materials handling efficiency, in better flow of sub-assemblies to the final motor assembly line, and through reduction in overhead expense.

Equipment for machining flywheels for the V-8, V-12, and the straight-8 LaSalle engines illustrates the concentration of a variety of models on a single set of machines with the purpose of cutting down the idle time of equipment, hence overhead per unit. The equipment is almost all entirely new, comprising heavier and faster machinery. Flywheels are run through in lots of 2,000 to 3,000 units for the V-8 and the LaSalle. An entire season's requirements for the V-16 may be run through in a single set-up. Flywheel production, as well as that of V-8 camshafts, is carried on in a space formerly vacant.

Crankshaft production for the three Cadillac models remains in the same space, but the V-8 line has been modernized and rearranged. Of particular interest is the materials handling system used for V-8 crankshafts. It consists of an overhead rail, with switches and a turntable, from which racks with a capacity of four cranks each are suspended. Spring balancers aid transfer of work from racks to machines..

In the first aisle, the work moves down and back in a tight loop, so that the racks are almost touching, back to back. On the return route, every other rack is an empty one on the way back to the starting point. Loaded racks are switched around to the second aisle. At this turn is a small section, made available through a more effective layout, where counterweights are machined and fed to the crankshaft line.

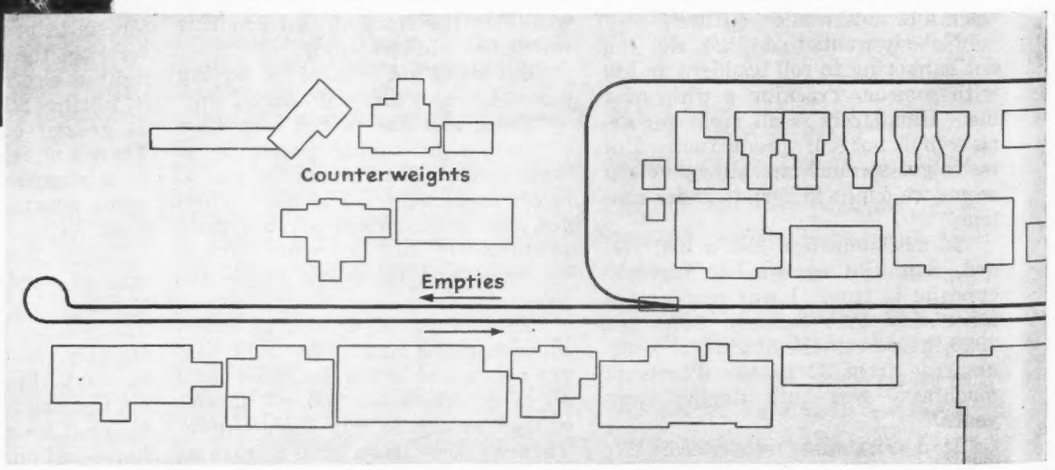
SPRING BALANCERS are a big help in handling V-8 crankshafts from machining operations to special racks suspended from an overhead rail conveyor. Note how the latter doubles back on its tracks down the main aisle of the department. Its complete course is shown in the accompanying floor plan

Conveyor as Bank

A bank of about 32 crankshafts is left on the line just after the balancing operations and before the subassembly of clutch and flywheel. At the take-off point is a turntable for reversing the racks so that the crankshafts may be lifted off directly into a hot-water rinse. Assembly of flywheel and clutch is accomplished while the crankshaft is supported vertically in a fixture, from which the unit is discharged to a short section of roller conveyor. Formerly, this assembly was performed after the crankshaft had been set in the engine block. The conveyor acts more as a bank than as a transportation device to the final balancing operation. This latter operation is a new one. It is no longer assumed that, because the units are balanced separately, the assembly is thereby in balance.

Automatic Balancing

By means of a block and chain on a monorail the assembly is handled in and out of the automatic balancing machine, with only a minor variation in height. Roller conveyors bring the units to the main motor assembly line, where another block and chain operated by air motor lifts them off and into the motor assembly. On the conveyors, the crankshaft travels flywheel-end up, but in the balancing machine the heavy end is down. Hence roll-over fixtures are provided at the conveyor ends close by the balancing machine.



to Take Up the Slack in the Cycle

Production of pistons and connecting rods is carried on in the same sections as before, but the equipment is largely new. Advantage has been taken of engineering changes to install new machinery, in which a number of operations have been combined. Thus much greater production is being achieved in the same space.

Here again much emphasis is being placed on balancing. Every connecting rod is made not only to exactly the same weight, but the respective ends of all rods are also balanced to insure identical units. This operation is performed on a profile miller whose depth of cut is controlled by the weight of each individual rod assembly.

Matched Pistons

The same technic is used in reducing all pistons to the same weight. Segregation of piston diameters by steps of 0.002 in. within a range of ± 0.001 in. of size is still current practice in matching pistons to the gaged bore diameters. Pistons are racked in coded steps, and piston sets are made up on order from the motor assembly line. Trays of selected piston and rod assemblies reach the assembly line by monorail.

Automatic screw machines have been moved from another building into the space formerly occupied by manifolds and the old V-8 cylinder blocks. In the process, the total number of machines has been reduced from 150 to 32, largely by better scheduling and planning with the idea of keeping every machine running all the time and by frequent changes in set-up. Thus overhead in the way of equipment, floor space, rental, supervision, lighting, and so on is considerably reduced, not only as a whole but much more so per piece.

It is apparent that our whole layout program has tended toward concentrating more production in less floor space, but this does not mean that we will end up by producing a complicated part on a single machine. It means, rather, that we have taken up a lot of slack in the manufacturing cycle that is not apparent at first glance.

Cadillac's move from four floors to one (April, page 148) concentrates more production in less floor space; saves handling, lighting, supervisory costs; is proof of the old adage not to let yourself get so used to the present position of the parlor furniture that you can't possibly picture it in any other arrangement

JOHN A. BUSER
Plant Layout Engineer
Cadillac Motor Car Company, Detroit

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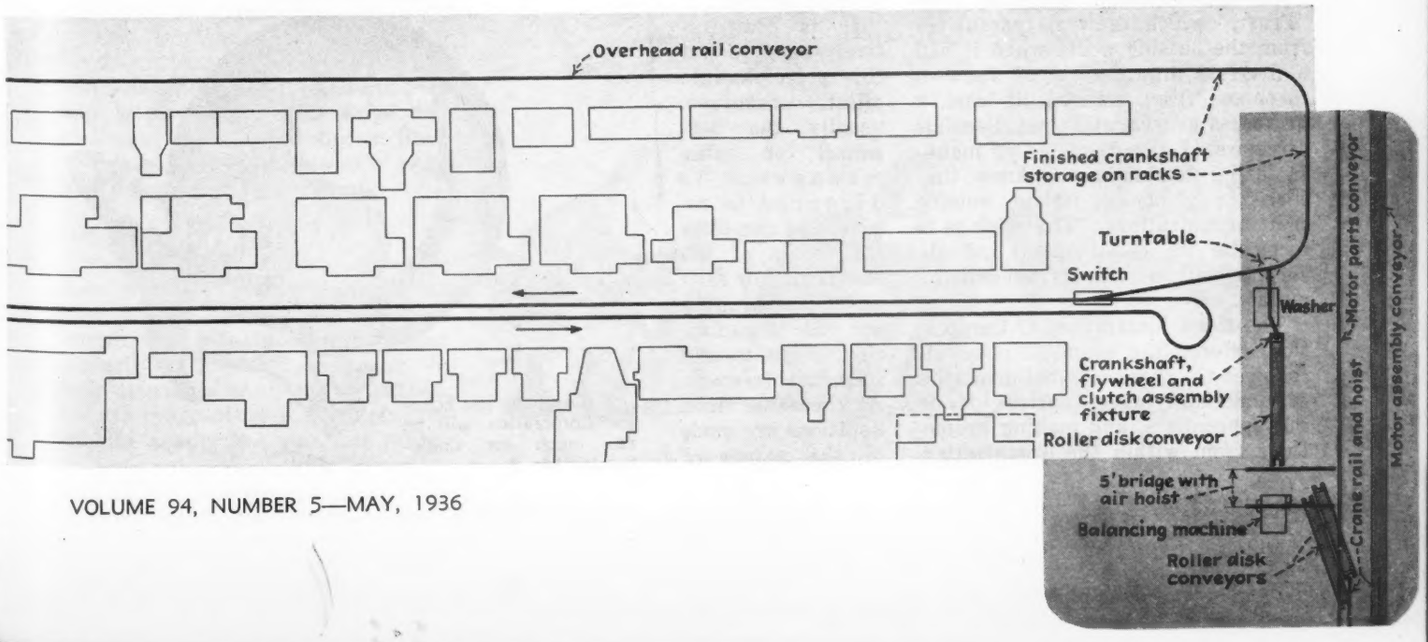
CRANKSHAFT production remains in the same space, but V-8 line has been rearranged to include counterweignt section and final balancing. Handling system consists of overhead rail conveyor, with switches and turntable, plus roller sections, rails, and hoists that move crankshafts through automatic balancing machine to motor assembly line



Organizing for Recovery

5. WHY EVERY CONCERN MUST BUILD FROM THE INSIDE

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Distinguishing characteristic of today's — and tomorrow's —successful manufacturing force is its adaptability to sudden change. A thorough examination of organization methods leads to the conclusion that adaptabiity is best secured by building up from the inside. Which includes understudying executives, training apprentices, promoting from within

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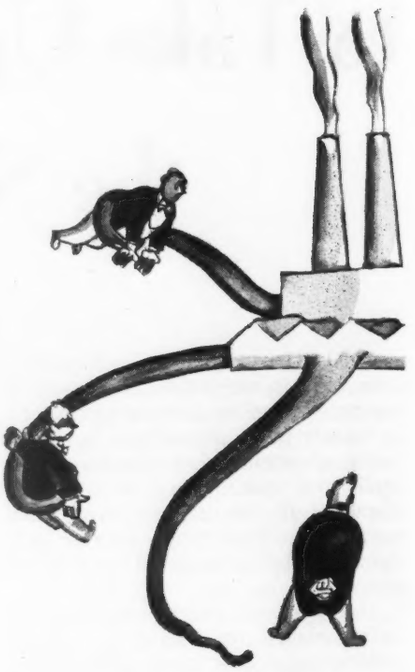


FREDERICK A. SMITH
President, Miller, Franklin, Bassett & Company
New York

IN THE three last articles we considered the workings of as many concepts of industrial management during the days of easy money and their ultimate fate when those days drew to a close. From our studies it is obvious that the organization wholly directed by one man and operated by a low-caliber, single-handed personnel, as exemplified by the Equator Corporation, is completely obsolete. It can, therefore, be dismissed without further consideration.

In the second example, the "Trust," which drew its executives from the outside world when it had a five-fold organization of its own to choose from, secured, at least, a first-class general manager. Sensible directors of the destinies of manufacturing establishments know that there is plenty of talent outside their organizations. The trick is to recognize its genuineness and absorb it without disrupting existing morale.

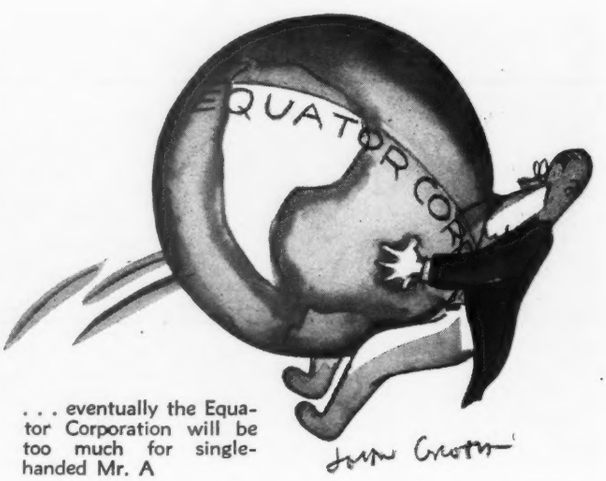
The third illustration, C Corporation, offered the soundest plan. It followed the three cardinal prineiples of understudying executives, training apprentices, and making promotions from within the organization. These principles can be applied to any business.

First, it will be readily admitted that in most organizations the duties of each executive are anything but sharply defined. Nor are they shared completely with any other one member of the organization who would be prepared to carry on in the executive's absence. Yet it is a prime requisite of good organization that the duties of each executive should be not only clearly defined but understudied as well.

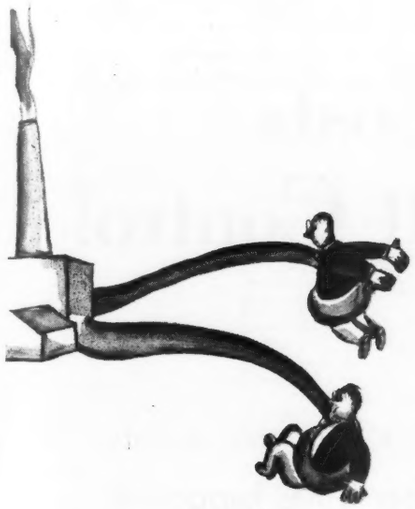
It is comparatively easy to put this principle into effect. Someone, usually the personnel or office manager, is directed to assemble complete statements of the functions of each executive throughout the organization, down to and including foremen. At the same time, notations are made of the names of any other persons who share those particular duties in whole or in part.

The man who shares most of the *shared* duties of an executive is his logical assistant, and should be so appointed and trained in *all* his duties. Some firmness may be necessary in putting this part of the reorganization into effect. When done thoroughly, the result is a two-ply organization strong enough to resist any demands upon it.

The second principle—training apprentices for each executive position —takes time if it, too, is to be done thoroughly. The younger the candidates are when they are put to work



. . . eventually the Equator Corporation will be too much for single-handed Mr. A



. . . something to be said for the "Trust's" method of seeking outside talent; at least it got a first-class general manager

systematically learning the business, the better. While this system of training should be started by those who are setting about reorganization as outlined here, a short-cut method must also be adopted. It can be very effective.

In this case, the apprentice is either someone already in the organization (which is preferable) or an outsider of an age consistent with the responsibilities of the position. He must necessarily be taught his job by his superior, probably with the aid of other subordinates.

The third principle of good organization is to do all promoting from within. Nothing insures loyal service and full effort more than the knowledge that any position in the company is within the reach of capable employees. On the other hand, nothing more completely dampens enthusiasm and ambition than to place outsiders in important positions over the heads of those who have given years to the company's service.

Facing a New Era

Now, while we should not ignore these lessons of tried experience, we must not be misled into believing that we can reorganize our weakened production machine according to their principles and let it go at that. We are confronting a new epoch in machine production, one into which the human element will enter to an unprecedented extent.

In the past, inventive brains evolved new products and machines to make them. When the salesmen had created a sufficient demand, the producers settled down to turn out volume without limit. These gigantic production machines — the plants brought into being by this procedure —became so fully automatic that the human organizations tended to degenerate into feeders of mechanical tools.

Meanwhile the admiring public was content to buy the startling new devices offered it—the annually improved cars, the household appliances, the radios, and the rest—without a question. The Joneses had them, so all the neighbors had to have them, too. Many of the articles thus purveyed fall under the general head of luxuries. In other words, it would be possible to get along without them. But during the whole course of the depression remarkably few people gave them up.

Still reduced incomes forced the Joneses to cut somewhere. This they did by economizing on necessities instead of luxuries. They wore out their clothes, let their homes run down or moved into cheaper quarters, and went on a Spartan diet. No inventive genius came to their aid by finding new materials and methods of manufacture of wearing apparel, or of building cheaper homes, or of devising mechanical means to raise, prepare, and distribute produce.

Yet that is precisely where the manufacturing outlook of the future lies. The market for all the mechanical gadgets to which our people have become accustomed will remain, and the kind of organization necessary to supply them with it. But the irresistible demand for new mechanical ways of producing necessities will undoubtedly give rise to a whole new series of industries employing a totally different kind of organization.

Instead of the permanent set of the giant plant, we may therefore expect to see a reversion to the adaptability of the smaller factories whose product will vary with the changing demand of the masses for things they need more than they do motor cars.

Obviously this will place a greater responsibility upon the manpower, since changes of product are only possible by adaptability of personnel, all the way down from heads to hands. It will call for greater imagination and skill on the part of the whole manufacturing organization. Heavier demands will be made upon those who direct the constantly changing operations.

No Crumbs

There will be no room for a weak, antiquated, or spiritless organization. There will be no crumbs left over from the strong organization's table. The successful manufacturing force of the future will be organized with almost military precision—each man with minutely defined duties, each officer with fully competent understudies, and each post filled by straight-line promotion. It will not, however, have the rigidity of military organization but the very opposite—that is, immediate adaptability to change.

If manufacturers are to be prepared to meet the competition of the future with alertness and effectiveness, that is the model according to which they must reorganize their present shattered forces.

. . . soundest plan is C Corporation's—understudying executives, training apprentices, promoting from within

Standard Costs for Profit Control

★

No cost system is worth a hoot that merely records the bad news after it has happened. There must be control. Else why bother?

PAUL E. GNAEDINGER
Industrial Engineer, Dominion Rubber Company, Inc.
Montreal

FIRST installment of this article was published in April. After clearing up some of the confusion that exists in the interpretation of the expression *standard costs,* Mr. Gnaedinger went on to consider the various elements of cost that provide proper control, began with materials, continues in this installment with direct labor costs.

Labor Costs

Direct labor includes all labor operations in manufacturing departments that can be definitely charged to specific products without being allocated on an arbitrary basis—in other words, all labor that can be allocated on the basis of so much per pound, per foot, per yard, per pair.

The first record to be set up is a list of standard wage rates. These rates can be determined by listing all the operations in the plant and grading them with regard to skill required, knowledge, hazardous conditions, unpleasant working conditions, and length of training period necessary, then relating the scale to a base wage for common labor in the district. The standard rates will not necessarily be the actual rates in effect in the plant, but should represent current wage rates in the district for similar classes of work. For proper cost control it is necessary to have accurate standards of output or standard times for every operation in the plant. Time standards should be set only after careful engineering studies have been made.

Under the direction of a capable engineer, complex labor operations can be analyzed into fundamentals and tabulated in such a way that standard times can be compiled synthetically for an almost unlimited variety of articles.

A practical example exists in the fitting room of a shoe factory where the various parts are assembled to form the upper of the shoe. With the vast array of sizes, lasts, and styles that result in practically an infinite variety of shapes and sizes of parts handled, the task of predetermining standard times bearing equitable relationship one with another seems at first sight to be insurmountable, and particularly so when these standards are required in advance of actual manufacture for a constantly changing range of styles. Yet, given proper engineering study, the time required for the various operations can be dissected, analyzed, and tabulated in such a way that the work of predetermining standard times becomes office routine whereby reference to a sample will indicate the operations that will be employed, and physical measurements referred to the standard tabulations will result in a synthetic standard time for the sample.

Such tabulations of basic data, once made, can be utilized for years—in fact, for as long a period as fundamental equipment and methods remain unchanged.

The next steps in the determination of labor costs parallel any other cost system in that they are determined by operations for all products. In standard costing, however, predetermined standards are employed instead of estimated actual costs.

Burden or Overhead Costs

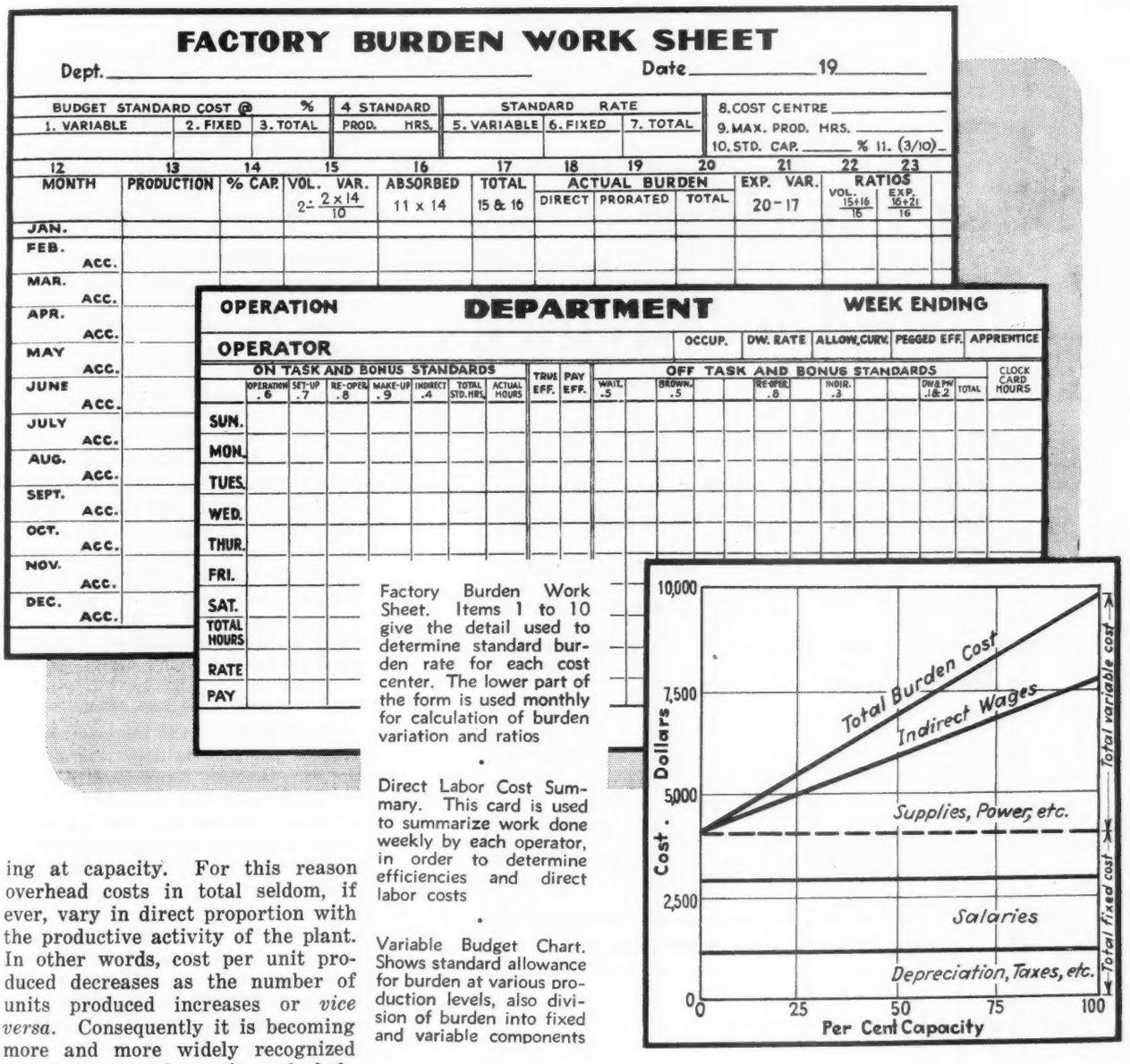
Burden includes all costs or expenses of manufacture not specifically included in direct materials and direct labor. Some of the expenses are fixed regardless of the volume of production; others vary with the degree of productive activity; other expenses are partly fixed and partly variable.

For close cost control it is recommended that the degree of variability be determined separately for each item of burden expense. This analysis should be made preferably by departments. Each item of expense should be studied in relation to productive activity to determine the amount that should be expended at each level of capacity. From this analysis, budget standards can be compiled to forecast the burden cost at any degree of productive activity.

One of the accompanying figures illustrates a so-called "variable budget" compiled to represent the allowed burden for a plant. From this chart the total burden cost, or the amount of the major components, corresponding to any degree of activity can be read directly. By the use of data of this character it is possible to compare actual expenditures with budget allowances. Variations of actual from budget or standard are known as "efficiency" variations; that is, the variation reflects the effectiveness of the management's control of burden expense.

Normal Volume of Production

Burden almost invariably includes certain items of expense that are fixed—that is to say, they are constant costs regardless of whether the plant is non-operating or operat-



FACTORY BURDEN WORK SHEET

Dept. _____ Date _____ 19____

BUDGET STANDARD COST @ %			4 STANDARD		STANDARD RATE			8. COST CENTRE
1. VARIABLE	2. FIXED	3. TOTAL	PROD.	HRS.	5. VARIABLE	6. FIXED	7. TOTAL	9. MAX. PROD. HRS.
								10. STD. CAP. ____ % 11. (3/10)_

12	13	14	15	16	17	18	19	20	21	22	23
MONTH	PRODUCTION	% CAP.	VOL. VAR. 2÷ 2×14/10	ABSORBED 11 x 14	TOTAL 15 & 16	ACTUAL BURDEN DIRECT	PRORATED	TOTAL	EXP. VAR. 20−17	RATIOS VOL. 15+16/16	EXP. 16+21/16
JAN.											
FEB.											
ACC.											
MAR.											
ACC.											
APR.											
ACC.											
MAY											
ACC.											
JUNE											
ACC.											
JULY											
ACC.											
AUG.											
ACC.											
SEPT.											
ACC.											
OCT.											
ACC.											
NOV.											
ACC.											
DEC.											
ACC.											

OPERATION **DEPARTMENT** WEEK ENDING

OPERATOR | OCCUP. | DW. RATE | ALLOW. CURV. | PEGGED EFF. | APPRENTICE

	ON TASK AND BONUS STANDARDS								OFF TASK AND BONUS STANDARDS								
	OPERATION .6	SET-UP .7	RE-OPER. .8	MAKE-UP .9	INDIRECT .4	TOTAL STD. HRS.	ACTUAL HOURS	TRUE EFF.	PAY EFF.	WAIT. .5		BROWN. .5		RE-OPER. .8		INDIR. .3		DW & PW .1 & .2	TOTAL	CLOCK CARD HOURS
SUN.																				
MON.																				
TUES.																				
WED.																				
THUR.																				
FRI.																				
SAT.																				
TOTAL HOURS																				
RATE																				
PAY																				

Factory Burden Work Sheet. Items 1 to 10 give the detail used to determine standard burden rate for each cost center. The lower part of the form is used monthly for calculation of burden variation and ratios

•

Direct Labor Cost Summary. This card is used to summarize work done weekly by each operator, in order to determine efficiencies and direct labor costs

•

Variable Budget Chart. Shows standard allowance for burden at various production levels, also division of burden into fixed and variable components

ing at capacity. For this reason overhead costs in total seldom, if ever, vary in direct proportion with the productive activity of the plant. In other words, cost per unit produced decreases as the number of units produced increases or *vice versa*. Consequently it is becoming more and more widely recognized that it is unsound practice to include in an article cost the amount of burden applicable to the product at the current rate of production activity. If this is done, it results in the following inequitable situation:

If a cost is compiled during a period of business inactivity, the overhead cost of any article is considerably increased, making it increasingly difficult for the sales department to dispose of the product. If, on the other hand, the cost is compiled during a period of relatively high activity, the article cost includes a low estimate of burden, and, if selling prices are based on this cost, the price is obviously too low. Therefore, before finding standard burden costs, it is necessary first of all to decide upon the normal rate of production to be used as a basis upon which to spread the total factory burden. Normal rate of production is generally considered to be the level of production that will supply average sales demand over an economic cycle.

Burden Cost per Article

After the normal volume has been determined, it is necessary to select the medium to be used for distributing the burden to individual products. There are a number of plans in general use, two of the most generally accepted ones being as a percentage of direct labor and the machine hour rate basis. The principles involved in all methods are the same. Percentage of direct labor will be taken as an illustration.

Three factors are involved in finding the percentage of direct labor to be used for the distribution of burden cost to individual articles—normal volume of production, estimated total burden cost at that level of activity, and amount of direct labor payroll at the same production level. The burden percentage may be determined for the plant as a whole, by departments, or by operations, depending upon the accuracy required. Generally speaking, the estimated costs become more accurate as the detail is refined.

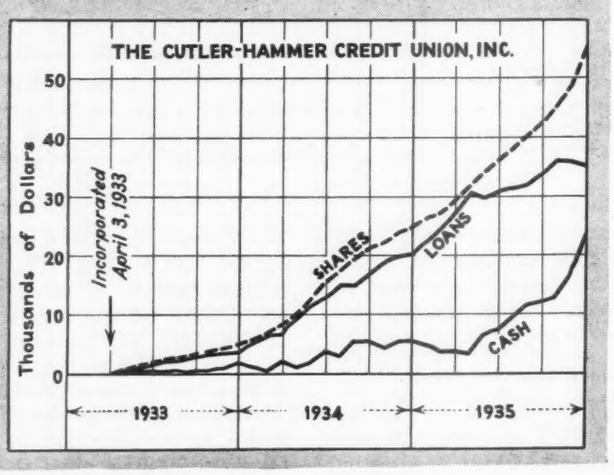
To determine the percentage, find the ratio of the estimated burden cost at normal capacity to the estimated direct labor cost at the same level and express this ratio as a percentage of direct labor. The amount of burden cost contained in any

(Continued on advertising page 50)

Slim Pickings for Shylocks

Wherever the credit union gets a foothold, the usurers get the boot. "Best thing, from the industrial relations standpoint, that we've ever had," says this personnel manager who has lived with a credit union for three years

A. J. HOLMES
Manager of Industrial Relations
Cutler-Hammer, Inc., Milwaukee



IN MILWAUKEE COUNTY we now have 115 credit unions, most of them organized within the past three years, and results show that most of the plants have done a great job of handling this type of cooperative endeavor. Most of these credit unions were organized by inside groups such as the works council or the welfare committee. Ours was started by the industrial relations manager after making a thorough investigation of where and how it would adapt itself to a concern employing about 2,500 people in normal times. At the time the union was started (April, 1933) we had about 1,200 employees, and since then it has kept pace with the increase in employment.

Sixteen employees, men and women selected from various shop and office departments of the plant, were asked to attend the formation meeting. They were selected for ability and initiative, because they were to become the first officers and directors. I should explain here that the state, through its Banking Commission, which controls all state credit unions in Wisconsin, has a representative to help organize and instruct new credit unions. This aid is rendered without cost. The state instructor was present at our initial meeting, explaining the state banking law requirements and pointing out our responsibilities.

During the first nine months, from April, 1933, to January, 1934, the credit union made 123 loans, averaging $83.40. The second fiscal year it made 409 loans, increasing the average $6.10 for an average of $89.50 per loan. Last year showed 699 loans with an average of $113. Total loans made in two years and nine months totaled $125,850.

Credit Union Sells Itself

The reason for the increase in the amount per loan is doubtless due to the fact that we were operating the credit union to the satisfaction both of those in the habit of handling larger loans and of employees in the higher wage brackets. We have never advertised or made a drive for new members, feeling that the credit union should sell itself. Every one of our members has joined without being solicited. We have had an average of 38 new members each month since organizing, and have issued 1,254 pass books. There has not been one cent lost on loans, and we have been able to pay a 6 per cent dividend each year in addition to accumulating $1,405 in undivided earnings, and $1,037.44 in the Guarantee

(Continued on advertising page 43)

WHY THEY BORROWED

Automobiles	$23,290
Furniture	10,140
Small Bills	9,430
Taxes	8,900
Insurance	8,500
Hospital & Medical	4,500
Coal	4,200
Clothes	3,300
Marriage	1,800
Gifts	1,400
Refrigerators	1,250
Washing Machines	1,000
Vacations	550
Radios	350
Stoves	240
Eye Glasses	100

So Your Walls Leak!

It's a common ailment, whose causes and successful treatment are not nearly so mysterious as they appear

PERRY M. MOORE
President
Maintenance Engineering Company, Inc.
Bloomfield, N. J.

MUCH research and discussion on the problem of building and maintaining waterproof masonry structures has led many laymen to regard waterproofing as a problem for experts only. As a result, the usual practice is to ask a few reputable waterproofers to bid on contemplated work on the basis of the lowest price for the longest "guarantee," with little if any regard for the specifications.

Everyone concerned with building maintenance can, however, apply sound reasoning to the waterproofing problem, and should exercise more control than is usual over the method of waterproofing. No engineer would think of letting a contract for concrete work on the basis of, say, a five-year guarantee, instead of specifying the composition and other details. There is no more reason why waterproofing should be contracted for on the basis of a guaranteed life.

Careful inspection of mortar joints in any building will reveal innumerable cracks, varying from 5 to 80 lineal feet of crack per 100 lineal feet of joint. Study of a large number of buildings has shown that this ratio is related to the type of mortar and brick used. Consequently there is some hope that contemporary research may eventually produce a wall that will not crack.

Causes of Cracking

Why building walls crack will be apparent when we consider the following conditions present in them:

1. Difference in coefficient of thermal expansion between mortar and brick.

2. Mortar and concrete swell approximately 2 in. per 100 lineal feet at a *constant temperature,* merely by wetting. This action is sponge-like and under heavy pressure can become negligible, which is probably the explanation for excessive cracking in the top few feet of the wall where there is little compression.

3. Under a difference in temperature between the exterior and interior of a building, there is a definite temperature gradient through the walls. If a brick wall is exposed to 70 deg. F. on the inside, and zero on the outside, the interior face of this wall is expanded and the exterior face contracted. In addition, there are numerous header courses through the wall that act as levers.

4. Normal building vibration will produce cracks, particularly around poor bonding surfaces, such as fire escape brackets and steel lintels.

5. Settlement stresses are nearly always present and although they sometimes reach equilibrium, it is well to recognize that minor movement may continue along the stress line established.

Under these conditions it is time we stopped blaming poor workmanship and faced the fact that we have not as yet placed the proper combination of materials in the workman's hands. When a certain twenty-story structure was built not many years ago the brick masons were told the the job was being performed on a "cost-plus" basis, and that any workman who did not fill every joint in a careful manner would be discharged. The brickwork naturally cost much more than the estimate, but it was a "perfect job." It is badly cracked today, and the building has had to have extensive waterproofing treatments because of leakage.

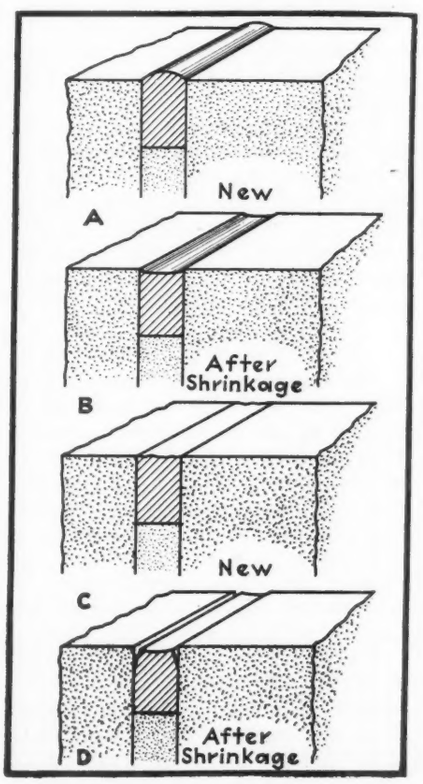


FIGURE 1. Much of the efficacy of calking depends on the tooling of the material in the crack. When a raised, or convex, bead is left, **A**, it will assume the shape shown at **B** after shrinkage. A flat or concave calk, **C**, will tend to pull away from the walls, as in **D**

Remedy: Pointing and Calking

It is evident, then, that in general all fissures in masonry walls must be regarded as *potential expansion lines,* and be treated accordingly. Treatment is divided into: (1) pointing, where minor movement may occur, as around single brick and other small masonry units; (2) calking, where major movement may take place, as is found around copings, stone sills, windows, steel work, and so on.

No rigid material such as ordinary mortar can be used to fill these cracks, with any hope of permanent cure. On many partial re-pointing operations where all cracked joints were cut out to a depth of ¾ in. and filled with new mortar, later examination has shown that frequently the

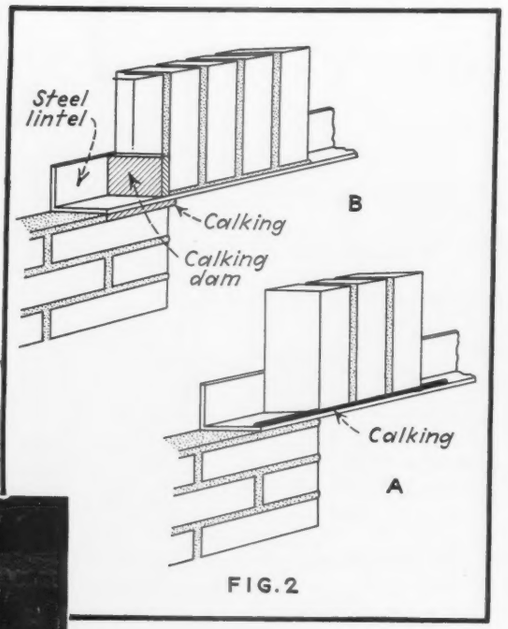
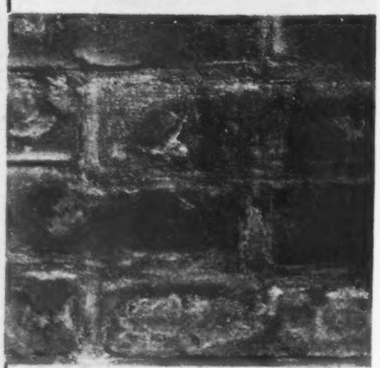


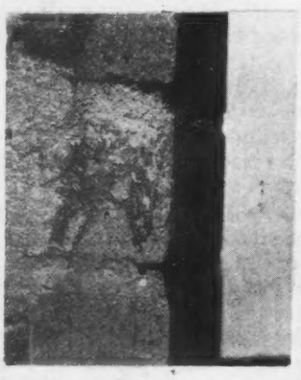
FIG. 2

FIGURE 2. Improper calking of angle-iron lintels, as at **A**, may result in damming up water in the angle, and letting it discharge into the interior of the wall. The proper method is shown at **B**; any water that gets in can readily flow out

UNTREATED



PLASTIC POINTED



PLASTIC PENETRATION

IN PLASTIC POINTING fill all fissures completely. Dark areas in view at bottom show proper penetration

new material is in perfect condition, but that new cracks have developed in the old mortar. Firm, strong mortar was placed between weaker mortar, and since nothing was done to change the stresses in the wall, the old, weaker mortar developed new cracks.

Most waterproofers will concede that plastic materials must be used around large masonry units, such as copings and stone sills, because they know that mortar will fail. In the same way all fissures around small units should be filled with a suitable plastic pointing material.

Pointing Small Fissures

For pointing small fissures it is best to use a plastic material that is applied in molten condition in order to secure a good bond and to resist the capillary attraction of the surrounding masonry. Of course, the material should not disfigure the building in any way. When compounds containing drying oils or solvents are applied in thin sections, harmful shrinkage may take place.

Where major movement is likely to occur, the limited elasticity of plastic pointing materials makes their use undesirable. Such joints must be cut out to a depth of at least ¾ in. and filled with suitable calking compound, preferably with a pressure gun.

Many excellent calking materials have frequently been condemned on account of improper application. A good calking compound should form a film or skin by oxidation, but the material should contain non-drying oils in sufficient quantity to keep the interior plastic. In order to have a plastic center, calked joints must have breadth as well as depth, and experience indicates that they should never be less than ⅜ in. in width for satisfactory results.

After the joint has been cut out and cleaned, the surface must be primed with some material, such as shellac, that is not soluble in oil. This prime coat must be thin enough to be absorbed into the masonry without leaving an actual film, since the weathering resistance of these materials is relatively poor and a heavy coat might cause a loss of bond.

To Tool or Not to Tool

It is advisable to finish the joint by light pressure tooling, to insure bonding to the sides of the joint, and trim off all thin edges left on the surface. However, if a strong "elephant hide" film is formed upon drying, tooling may be disastrous, as shown in Figure 1. Since tooling forces the initial cross-section to a straight or concave surface, the subsequent shrinkage brings the tough, top skin in tension against the bond to the sides of the joint, causing rupture of the bond. A convex bead, however, will permit of considerable shrinkage before tension against the bond can occur, and is necessary for most calking compounds.

Joints around window frames, projecting courses, and the like may be calked successfully in the right-angle formed without cutting out, provided great care is taken to clean the surfaces, prime well, and give ample body to the bead of calking compound, forming a convex surface.

An error frequently made in calking is the promiscuous damming up of building units such as cap flashing or spandrel courses, which are designed as "dump out" points. Do not regard remedial waterproofing as 100 per cent watertight and discontinue the necessary function of a building unit. Where remedial calking is necessary, small bleeder outlets that will permit water to drain out but not allow it to enter should be made at frequent intervals.

Where through-flashings are not turned down on the exterior face for at least ½ in., consider calking the under side of the flashing to prevent runback into the brickwork.

Calking across the face of an angle-iron lintel over windows or doors is a serious mistake. Figure 2 shows how it will, in effect, form a

(Continued on advertising page 53)

CHECKING automobile engine pistons is only one of many similar uses for electric limit gages. They measure to 0.01 mil

FOUR DIMENSIONS are checked simultaneously, as easily as one, with the electric limit gage the young lady at the left is using

New Instruments for Industry

Electric devices that measure color and sound; gages that deal in hundred-thousandths of an inch and measure one or many points simultaneously; a meter that tells the thickness of enamel merely by touching it—dreams yesterday, ready today for the jobs that await them

EVERETT S. LEE
General Engineering Laboratory
General Electric Company, Schenectady

SIMPLE DEVICES for measuring the weight and dimensions of objects are as old as the proverbial hills, and until comparatively recently they were about all that industry needed. The situation is entirely different today. Requirements for speed and accuracy of measurement of various physical properties have been made much more severe. In addition, close measurement of properties and characteristics that were heretofore given little attention has been demanded and means for accomplishing it provided.

In this and a succeeding article a few examples will be given of the new, electrically operated tools that have been made available to the production and inspection departments of manufacturing industry.

One of the most useful of these tools is the electric gage. When the part to be checked is slipped into the gage the contact piece resting on the part moves to conform to the dimension and thus affects an electric circuit which actuates the pointer of the instrument. With a good, reliable electric gage a variation of 0.0001 in. in the dimensions of the part will cause the pointer to move about 1 in., thus allowing measurements to be made to 0.01 mil. If the part has to be rejected, the amount by which it exceeds the limits is accurately known, so that the necessary adjustment can be made at the machine to keep rejections at a minimum.

One of the illustrations shows a group of simple electric limit gages for measuring the dimension of one part.

For parts that require more than one inspection measurement, two—, three—, or four-point gages may be made to fit almost any required inspection program. The gage shown in another illustration checks simultaneously four external measure-

ments, including the bearings and crankpin and the squareness of the ends of the shaft of an electric refrigerating machine. Just as soon as the piece is put into position by the operator the four pointers show the four dimensions.

From Steel Strip to Enamel

The principle of the electric gage has been extended to the measurement of the thickness of steel strip; if desired, a continuous record can be made of the thickness of the strip. Automatic sorting of parts according to the dimensions is also feasible.

The electric gage is operated from an ordinary alternating-current circuit of 60 or 50 cycles frequency at 110-115 volts. The principle of operation is based on the change in reluctance of a flux path. When a piece of work is brought under the spindle of the gage the armature is moved out of its central position, unbalancing the magnetic fields between two coils. A relatively large unbalanced current is produced by a very small movement of the armature, and the result shows visibly in a corresponding movement of the needle of a micro-ammeter. Thus a high degree of accuracy of measurement is obtained, with practically instantaneous response.

Closely allied with the electric gage is the enamel thickness gage, also electrically operated. It is so called because it was first used to measure the thickness of the enamel on metal sheets used in the manufacture of electric ranges, refrigerators, and other appliances. Now its use is rapidly being extended to other fields. Savings in enamel made by keeping its thickness to an optimum value are sufficient to justify the use of the gage.

It consists of a gage head which is held in the hand and placed on the enamel surface whose thickness is to be measured. An indicating instrument shows the thickness of the enamel as soon as the inspector presses the gage head on the enamel surface.

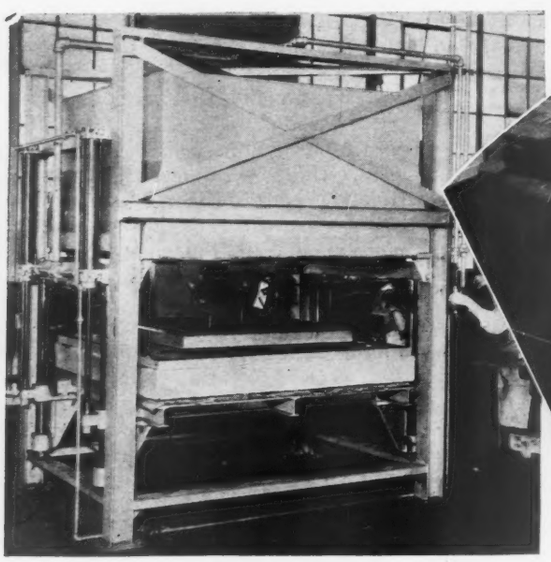
In a measurement such as this the trick, of course, is to measure the thickness of the enamel alone. An over-all measurement by other means is useless unless the thickness of the iron sheet is also known, which it usually is not, and practically never with the necessary exactness. With this gage only the magnetic quality of the sheet need be known. This is determined by first calibrating the gage, using a sample of the sheet material together with celluloid or similar strips as spacers in place of the enamel.

The enamel thickness gage may be had with various scales reading from 1 mil to 5 mils, 5 mils to 25 mils, and so on. Minimum thickness measurable is about 0.5 mil, with the maximum up to 250 mils. Accuracy is 2 per cent of full scale for any of these scales, with a minimum accuracy of 0.1 mil. The gage may be used to measure the thickness of other non-magnetic finishes on magnetic sheet.

It's Based on Changes in Flux

Operating from a 110-volt, single-phase circuit, the enamel thickness gage depends on the change in reluctance of a flux path. The coil in the gage head, which is excited from the supply voltage, sets up a flux from the inside to the outside of the head that passes through the enamel and the supporting magnetic sheet. The enamel is non-magnetic; hence the amount of flux depends upon the

(Continued on advertising page 44)



Good little motors should be seen, not heard; so they are checked in a noise-booth

"Just a moment, and I'll tell you how thick this enamel is"

When it "sees" a color, the recording photoelectric spectrophotometer analyzes it and writes down the composition

A.C. Wave Windings

Connecting diagrams and tables for windings having 4½ slots per pole per phase

A. C. ROE
Railway Engineering Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

THE PRECEDING article, in the January issue, treated simple windings having no phase or other special coils. Procedure in winding with phase coils will now be discussed, with suggestions on marking the core to insure proper location of the various types of coils. In addition, the connecting diagram, Figure 6, Connecting Chart VI and Checking Table VI for windings having 4½ slots per pole per phase will be presented.

Assume an 8-pole, 3-phase winding for 108 slots having 6 conductors per slot or 4½ slots per pole per phase. In this instance we will assume that all coil leads are the same; that is, there are no special, short-lead coils.

With 8 poles and 3 phases, there are 24 pole-phase groups. These groups will require 48 phase coils, of which 24 will be right-hand phase coils, and the other 24 will be left-hand phase coils. The fact that there are more than two conductors per slot necessitates the use of right- and left-hand phase coils.

From Connecting Table VI it will be seen that the lead coils will use up twelve phase coils, six right- and six left-hand. All the top lead coils, *A3, A4, B3, B4, C3, C4,* are right-hand phase coils. There remain 36 phase coils, 18 right hand and 18 left hand.

Two Ways to Arrange Coils

Two general methods are used for arranging the coils preparatory to winding:

The first step is to sort out and put the coils into three piles; that is, the plain coils are put in one pile, the right-hand phase coils in another, and the left-hand phase coils in the third.

Next, determine the coil grouping; that is, the number of coils per group, and whether odd or even. The checking chart is used to obtain these data, which for the 8-pole 108-slot winding, is 5, 4, 5, 4, and so on coils per group.

The first method of arranging the coils and winding consists in leaving the coils in three piles, locating slot *1* in its proper relation to the slip-ring connection, and starting the winding with a left-hand phase coil in that slot. Then continue in a clockwise direction, putting three plain coils in slots *108, 107,* and *106,* respectively. A right-hand phase coil in slot *105* completes the first five-coil group.

The next group, which has four coils, is started by putting a left-hand phase coil in slot *104,* and two plain coils in slots *103* and *102,* ending the second or four-coil group with a right-hand phase coil in slot *101.* Then put in a five-coil group as above and follow it with a four-coil group, continuing in this order until all coils are in.

With this method of winding the coils are picked from each pile in

Checking Chart VI*
4½ Slots per Pole per Phase

No. of Slots	No. of Poles	Polarity	Phases C						B					A				
54	4	↑	10	9	8	7	6	...	5	4	3	2	1	Z	Y	X	W
		↓	...	23	22	21	20	19	18	17	16	15	...	14	13	12	11
		↑	37	36	35	34	33	...	32	31	30	29	28	27	26	25	24
		↓	...	50	49	48	47	46	45	44	43	42	...	41	40	39	38
81	6	↑	64	63	62	61	60	...	59	58	57	56	55	54	53	52	51
		↓	...	77	76	75	74	73	72	71	70	69	...	68	67	66	65
108	8	↑	91	90	89	88	87	...	86	85	84	83	82	81	80	79	78
		↓	...	104	103	102	101	100	99	98	97	96	...	95	94	93	92
135	10	↑	118	117	116	115	114	...	113	112	111	110	109	108	107	106	105
		↓	...	131	130	129	128	127	126	125	124	123	...	122	121	120	119
162	12	↑	145	144	143	142	141	...	140	139	138	137	136	135	134	133	132
		↓	...	158	157	156	155	154	153	152	151	150	...	149	148	147	146
189	14	↑	172	171	170	169	168	...	167	166	165	164	163	162	161	160	159
		↓	...	185	184	183	182	181	180	179	178	177	...	176	175	174	173
216	16	↑	199	198	197	196	195	...	194	193	192	191	190	189	188	187	186
		↓	...	212	211	210	209	208	207	206	205	204	...	203	202	201	200
243	18	↑	226	225	224	223	222	...	221	220	219	218	217	216	215	214	213
		↓	...	239	238	237	236	235	234	233	232	231	...	230	229	228	227
270	20	↑	253	252	251	250	249	...	248	247	246	245	244	243	242	241	240
		↓	...	266	265	264	263	262	261	260	259	258	...	257	256	255	254
297	22	↑	280	279	278	277	276	...	275	274	273	272	271	270	269	268	267
		↓	...	293	292	291	290	289	288	287	286	285	...	284	283	282	281
324	24	↑	307	306	305	304	303	...	302	301	300	299	298	297	296	295	294
		↓	...	320	319	318	317	316	315	314	313	312	...	311	310	309	308

*To be used with Figure 6 and Connecting Table VI.

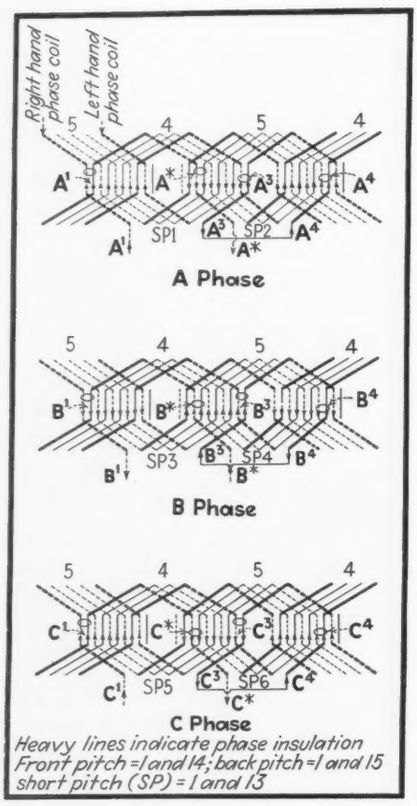

Right hand phase coil
Left hand phase coil
A Phase
B Phase
C Phase
Heavy lines indicate phase insulation
Front pitch = 1 and 14; back pitch = 1 and 15
short pitch (SP) = 1 and 13

FIGURE 6. Connecting diagrams for a.c. wave windings having 4½ slots per pole per phase. These diagrams are to be used with Connecting Table VI

rotation as required, and the winder must be constantly on the alert to prevent mistakes in the way of wrong placement of phase coils or incorrect grouping.

The second method requires more care at the time of laying out the coils. It involves arranging the coils on a bench in their proper phase-coil arrangement and number of coils per group. However, there is a little trick in this method which if not watched will upset the whole arrangement.

Reverse the Order

This trick consists in arranging the coils on the bench in the reverse order to that in which they are wound into the rotor or stator. For example, consider a winding with even grouping, as shown in Figure 5 in the preceding article, having four slots per pole per phase. In laying out the coils on the bench, start with a right-hand phase coil and end the first group with a left-hand phase coil. Continue in this way until all coils have been laid out, with the proper number of coils per group, and the reverse, phase-coil arrangement.

Watch the Grouping

With the coils laid out in this way the last coil on the pile will be a left-hand phase coil; it will also be the first coil picked up to start the winding. Picking the coils in proper sequence from the pre-arranged pile, and winding the rotor or stator in clockwise direction (facing the collector ring end) will insure the correct phase coil arrangement, and the proper number of coils per group.

This method of laying the coils out on the bench in one pile is based on even grouping (2, 3, 4, 5, and so on slots per pole per phase) and more than two conductors per slot. When the grouping is odd, as for 2½, 3½, 4½, 5½ slots per phase, and more than two conductors per slot, which involves the use of right- and left-hand phase coils, there is one more check that must be made before laying out the coils.

With odd grouping, the first group in the coils laid out on the bench must have the same number of coils as in the group to the left of the *A1* lead in the connecting diagrams.

Start with a Left-Hand Coil

For example, consider the 8-pole, 3-phase, 108-slot winding shown in Figure 6 and covered by the connecting and checking charts, having an odd grouping of 5, 4, 5, 4 and so on coils per group. From Checking Chart VI it will be found that the last group to the left of the *A1* lead in slot *1* has four coils, in slots *5, 4, 3, 2*. Therefore, the coils on the bench should start with a right-hand phase coil, followed by four coils per group, and end with a left-hand phase coil. The next group should have five coils, then four, and repeat, the last group having five coils.

Hence the winding would start with a left-hand phase coil in slot *1*, and end the first group in slot *105* with a right-hand phase coil. It will have five coils per group, the coils being wound on the armature in a clockwise direction, or opposite to the numbering.

Next Time

The next article will present the connecting diagrams and tables for windings having five slots per pole per phase and in addition will discuss short-pitch coil windings.

Connecting Table VI*
4½ Slots per Pole per Phase

		A Phase				B Phase				C Phase				Short Pitch Connections	
No. of Poles	No. of Slots	Bottom Leads A1	A*	Top Leads A3	A4	Bottom Leads B1	B*	Top Leads B3	B4	Bottom Leads C1	C*	Top Leads C3	C4	SP 1–3–5	SP 2–4–6
4	54	↑ 1	41	38	25	↓ 19	5	2	43	↑ 37	23	20	7	4	3
6	81	↑ 1	68	65	52	↓ 19	5	2	70	↑ 37	23	20	7	4	3
8	108	↑ 1	95	92	79	↓ 73	59	56	43	↑ 37	23	20	7	4	3
10	135	↑ 1	122	119	106	↓ 46	32	29	16	↑ 91	77	74	61	4	3
12	162	↑ 1	149	146	133	↓ 100	86	83	70	↑ 64	50	47	34	4	3
14	189	↑ 1	176	173	160	↓ 127	113	110	97	↑ 64	50	47	34	4	3
16	216	↑ 1	203	200	187	↓ 73	59	56	43	↑ 145	131	128	115	4	3
18	243	↑ 1	230	227	214	↓ 181	167	164	151	↑ 91	77	74	61	4	3
20	270	↑ 1	257	254	241	↓ 181	167	164	151	↑ 91	77	74	61	4	3
22	297	↑ 1	284	281	268	↓ 100	86	83	70	↑ 199	185	182	169	4	3
24	324	↑ 1	311	308	295	↓ 235	221	218	205	↑ 118	104	101	88	4	3

*See Figure 6 for connecting layout. Front pitch = 1 and 14. Back pitch = 1 and 15. Short pitch (SP) = 1 and 13

You want to know

and the editors will gladly tell you more about the things mentioned on this page

• NON-SKID ladder shoes grip like anything on wood, steel, and concrete floors, even when wet, icy, or oily. Self-aligning, they assure solid footing on uneven surfaces. Positive stop prevents ladder from being set up at unsafe angles. (5601)

• HIGH GLOSS baking enamel, new, withstands heat from burning cigarettes with discoloration or softening; retains its finish even after being immersed in alcohol for an hour. (5602)

• 30-HOUR WEEK is "labor's enemy No. 1," merely divides the work instead of multiplying it, is a share-the-work scheme—according to a recently published graphic analysis which shows the fallacy of this proposal. (5603)

• FIRST-AID KIT for industrial use has double steel cases. One is fastened to the wall. Other actually holds the first-aid material, is quickly detached and easily carried. (5604)

• SOCKET WRENCHES are held at a slight angle in a new molded rubber holder, are therefore easily picked up and replaced. There's a separate receptacle for each wrench. (5605)

• ONE-COAT bonding solution, its manufacturers aver, makes sure that rubber linings and coatings will stick to the smoothest surfaces. (5606)

• SLOTTED NUT offers from 10 to 22 instead of the usual 6 adjustments per turn, stays tight longer, is applied in far less time than the standard variety. (5607)

• FIRST ISSUE of a paper-testing instrument manufacturer's house organ contains first of series of articles on paper testing written so nontechnical readers can understand them. Want to get on the mailing list? (5608)

• PAINT GUN—what we like about it is when you start to use it, air passes through first to clear the sprayhead, and when you're done the paint shuts off first and again air clears the sprayhead. (5609)

• CIGARETTE lighter you've admired in boudoirs and board rooms is produced in two molding operations complete and ready for wiring. Worth looking into, these plastics. (5610)

• MIRRORS that won't tarnish—both first and second surface types, in case you're interested—can now be had. (5611)

• RAPID REPRODUCER—from England—uses simple photo-printing process, makes reproductions of anything written, drawn, stamped, or printed. Office boy can run it. Time-clock control averts failure. (5612)

• TABULATING unit for keeping statistical records is made up of card trays that rest on a sliding shelf and have collapsible handles. (5613)

• PIPE for underground or overhead lines carrying steam, hot or cold liquids, brine, or ammonia has heavy magnesia insulation over which an airtight coating of asphaltum is applied. (5614)

• ELECTRIC heating pliers are available for electrical maintenance and production uses, hold work while it is being soldered. Plug into any 110-volt a.c. light socket and heat is instantly available at the jaws of the pliers. (5615)

• SKID PLATFORM, pressed steel, of deep integral rib construction, will take more abuse, says its manufacturer, than any other on the market. (5616)

MOST USEFUL gadget of the month promises to be this sturdy opener they're using to operate on fiber shipping cartons. Its molded plastic case contains a razor blade which is adjustable to cut to any desired depth. A single screw makes all adjustments. (5623)

• WATERPROOFING process for treatment of masonry has been improved by adding aluminum priming coat to the black waterproofed surface. Now a final finish in any desired color may be had. (5617)

• PAINT STRIPER, relatively small and inexpensive, holds enough for a continuous stripe from 300 to 1000 ft. in length. Has automatic feed and automatic return for surplus that prevents dripping. Can be used horizontally, vertically, or for overhead work. (5618)

TANNIC ACID is best thing yet discovered for burns. The nurse sprays it on quickly and painlessly with this atomizer. Marking on bottle indicates acid and water levels for a 10 per cent solution. (5624)

• PRIMARILY for spot repair work and touch-up jobs on synthetic enamel finishes is a new refinishing material that does not fade or flatten out. (5619)

• SYNTHETIC WOOL made from casein and now commercially available in Italy is said to be warmer than natural wool. (5620)

• YEAST that tastes like bacon is being sold in a glass jar with a screw cap perforated to form a shaker top. Friend wife labels it appropriately after the yeast is gone and uses it for salt, pepper, etc. (5621)

• LATEST contribution of the food industries to the more abundant life is the non-smear ice cream stick. You unwind as you eat. A compartment in the bottom holds a napkin. (5622)

Operating Shorts

Wooden Tote Boxes that Nest and Slide

ROGER C. DICKEY
The International Paper Box Machine Company, Nashua, N. H.

Wooden tote boxes are much used for transporting unfinished articles through the plant. They have low first cost and are fairly long lived. When they can be piled one on top of another without damage to the articles in them, much valuable floor space is saved. There is also advantage in being able to transport a pile of boxes from one point to another by means of a hook. Often, too, boxes can be glided from machine to machine, saving steps and avoiding the necessity of men leaving their places. The size of the box is governed by the size and number of parts which make up a manufacturing lot.

Holders for supporting the boxes can be attached to machines at convenient points. All boxes should be uniform in size, so that any box will fit the holder, and holders should be furnished for unfinished as well as finished work boxes, eliminating the necessity of benches around machines.

Card holders can be attached to the sides for time cards, production schedules, manufacturing instructions, etc. Boxes may be painted red to designate rush work, or other colors designating departments to which the boxes are to be transported.

The box shown in the illustration is made from ordinary ½-in. box board. Ends are ⅜-in. stock. Cleats on the bottom are just long enough and just far enough in from the sides to fit into the top of another box, with perhaps ⅛ or ¼ in. clearance, and serve as nesters. Both bottom cleats and those around the top of the box are nailed and the nails clinched. Cleats should be 1½ in. wide.

On each end of each bottom cleat are fastened gliders or sliding casters. Any box maker can make up the boxes, and the sliding casters can be secured at a five-and-ten-cent store.

The tote box holder is made of ⅛x1¼-in. cold rolled stock. Ends are flanged slightly. The fit should be fairly snug so that vibration of the machine will not shake the box out of the holder. Attach holders to metal parts by countersinking the holes and using ¼-in. flat-head machine screws.

Careful study should be given the location of holders for both finished and unfinished work boxes. Motion analysis will determine the ideal locations so that operators may reach for a part, perform the operation, and deliver the finished piece to its box with least effort and in the shortest possible time.

Mr. Dickey's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

•

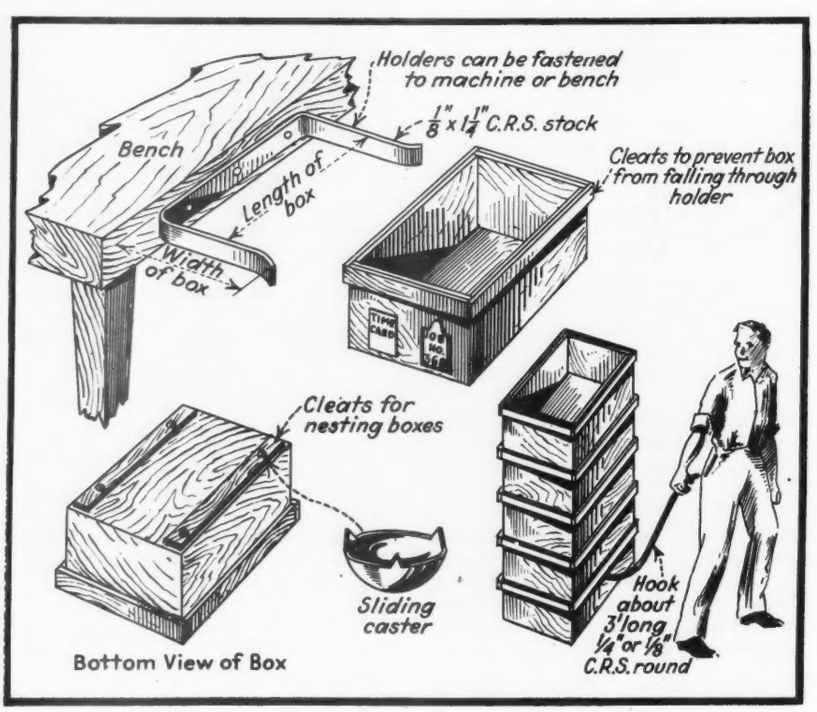
$4-a-Day Saving by Electric Drive

T. A. BISSELL, *Chicago*

Power for a 20-ton vertical ice machine used by the Agar Food Products Company, Chicago, was supplied by a steam engine, direct-connected. The cost of powering this machine was high, especially in summer when the boilers had to be run solely for this purpose. In winter exhaust steam was used for heating. But there were always the week-ends when no heat was required, yet the ice machine had to be kept going.

Electric drive was substituted. It required purchase of a 40-hp., 860-r.p.m. motor, 18½ ft. of 10-in. leather belting, a vertical pivoted motor base, two pulleys, and some steel supports—at a total cost of $420.

Operation under the new set-up showed a saving of approximately


Holders can be fastened to machine or bench
1" x 1¼" C.R.S. stock
Bench
Length of box
Width of box
Cleats to prevent box from falling through holder
Cleats for nesting boxes
Sliding caster
Hook about 3' long 1/4" or 1/8" C.R.S. round
Bottom View of Box

Presenting National Folding Box Company's variation of the always excellent practice of identifying the plant. For years this New Haven concern has maintained this sign where 30,000 "New Haven" passengers a day can read it. The product—always a nationally known one—is changed monthly

$4 a day over the old. This saving represents the difference between the cost of current used and the cost of 200 gal. of oil required for running the ice machine alone from the boilers. It was further discovered that this $4-a-day saving applied as well to periods when the boilers were used for heating, since fuel consumption jumped 200 gal. a day when the ice machine was steam driven.

The $420 investment paid for itself in 105 days of operation and has been earning a clear profit of $4 a day ever since.

The number of workers killed last year, 16,500, was less than half the number of deaths in occupational accidents 25 years ago. National Safety Council estimates that 22 years of organized industrial safety work have saved 250,000 lives.

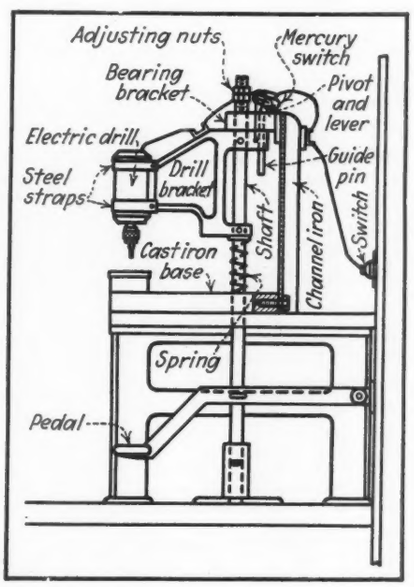
Motion-Economized Assembly Layout

JOHN A. HONEGGER, *New York*

Give an operator an efficient way in which to produce his daily lot and costs will tend to take care of themselves. This was recently illustrated in the plant of an electrical manufacturer, where in one assembly girls placed three parts together, reamed a hole, and inserted and hammered a small pin into place.

By the old method, the parts were assembled in a fixture which was placed under a conventional drill-press. While one hand held the parts in place, the other pulled down the spindle lever to ream the hole. After the lever had been released, the pin was inserted and driven home with a small hammer.

It was necessary to increase the production of these parts without materially increasing the labor or equipment costs, in order to meet



competition. After a study of the job had been made, the set-up shown here was developed.

It consists of a cast-iron base to which was bolted a section of channel iron. At the top of the channel a bearing bracket was bolted, and holes in it and the base acted as bearings for a shaft upon which was mounted a drill bracket. To keep this bracket from swinging out of line a guide pin was inserted through it and the bearing bracket.

On the front of the drill bracket an electric drill (with handle grip and trigger switch removed) was mounted by means of steel straps. A mercury switch was mounted on top of the bearing bracket, and connected to the drill bracket by means of a pivot and lever.

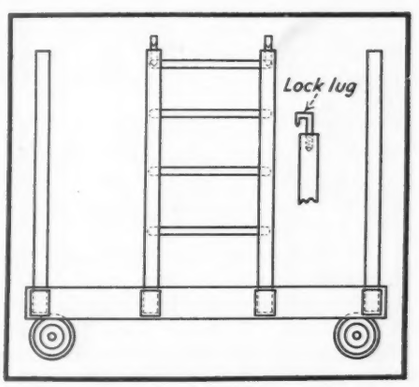
Raising and lowering of the drill bracket is accomplished by operation of the pedal. When the pedal is released, the spring returns the drill to its uppermost position. This tilts the mercury switch and stops the drill. As the bracket is lowered, the lever tilts the switch, and the mercury flows to the other end of the tube, closing the circuit.

Use of the foot pedal leaves both hands free to perform the operations of assembling the parts and holding them in the fixture for drilling. Both hands are also free to pick up the pin and hammer.

Ladder Mounted on Truck for High Stock Bins

J. MURPHY, *Kokomo, Ind.*

In filling orders from high stock bins our stock men frequently have need for a short ladder to reach material. Since the stock is loaded on a hand truck, we built a small ladder and mounted it on the side of the truck. This ladder sets into stake holders and, when not in use, acts as a retaining side. Inserted in the top ends of the uprights are lock lugs fitting into perforations on



the edges of the bin shelves. In this way movement of the truck is prevented while a man is working from the ladder.

Conveyor Serves Pretzel "Benders"

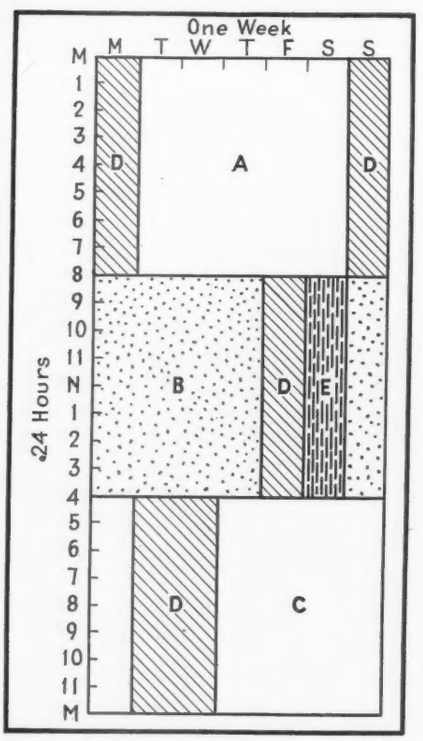
SOURCE, *Lectonia Pretzel Company Lectonia, Ohio*

They are still "bending" pretzels by hand in this modern factory. But outside of this lone hold-out, everything else is mechanized. The plant has been completely conveyorized, and only through the installation of this equipment has the company been able to satisfy increased demands for its product. Belt conveyors, in short, carry pretzels from mixer to package.

After being extruded and automatically cut to length, pretzels-to-be drop on a 12-ft. belt conveyor, 18 in. wide. Girls standing on either side of the conveyor "throw" strips into pretzel shape, place them on boards from which they are transferred to racks on an overhead chain conveyor.

Moved to the cooker on this conveyor, pretzels pass through the cooker and drop on a series of ¾-in. rollers set at an angle. Down these they roll to the oven conveyor.

As they enter the ovens, salting takes place; then baking, as the conveyor moves pretzels through the 21-ft. oven. Turning back through 180 deg., the pretzels, now in boxes into which they have dropped at discharge end of oven, are passed through a 21-ft. dryer on another overhead chain conveyor. At the conclusion of this process they are ready for packaging.



They Always Know Their Shift Schedule

C. S. LINDER, *Elwood, Ind.*

The diagram shows an easy way to keep track of shifts in a plant that operates continuously.

Our factory program calls for a maximum of 40 hr. per week and at least one full day free, preferably two days. With the consent of the men, we arranged for A to be always on the night shift; B, by virtue of seniority, to take the day shift; C to take the evening shift; and D, the youngest man in service, to take the irregular shifts. An extra man, E, from the factory day gang, works the odd 8-hr. shift on Saturday.

This arrangement is permanent, and every man knows his exact hours without having to study a posted schedule. We tried the rotating type of schedule at first, but the men became confused, and a shift was likely to fall due without the man being on the job.

It is to be noted that D has plenty of time (32 hours) for rest between the changes in his shifts. As a matter of fact, all the D men have gotten to like their awkward schedule and prefer to remain there.

•

When It Pays to Separate Liquid Wastes

S. H. COLEMAN, *Waynesboro, Va.*

Waste effluent, other than sewage, from the average manufacturing plant usually consists of liquids. Some of these are inoffensive; others require treatment to remove undesirable characteristics before ultimate disposal. Usually the inoffensive liquids predominate. Where this is true and the total quantity of effluent renders the procedure economically sound, segregation is desirable.

Investment in a purifying plant for waste liquids depends largely on the quantity to be handled. Obviously, it is wasteful to build a large plant to handle a mixture of liquids of which only a small percentage requires treatment. It is always necessary to weigh the relative costs of a large treating plant and a single piping system against those of a small plant with duplication of piping.

In one instance it was found necessary, after the construction of a disposal plant, to separate a small quantity of waste liquid from the main disposal system in order to avoid excessive maintenance charges and eliminate the danger of failure of the whole system. No treatment was necessary, ultimate disposal requiring only a pumping station to raise the waste liquids to a higher level for discharging.

After the system had been in service for a short period the cast-iron impellers on the large pumps failed from corrosion. A little later the pump casings and the check valves in the discharge lines had to be renewed. After several costly renewals

a check was made of the piping system to determine the source of the corrosion. It was found that acid material comprised only about 6 per cent of the total quantity of waste liquid. Disposal of this waste in a separate piping system having a gravity flow to the final disposal point effected substantial savings in maintenance costs.

•

Blower Solves Problem in Finishing Beer Kegs

LEONARD CHURCH, *Cleveland*

In the manufacture of steel beer kegs, the problem of exhausting the lacquer vapor from the keg interior and air-drying it rapidly before baking, confronted one manufacturer.

The inside coating, a special lacquer, serves as the base for a subsequent covering of pitch. To secure a good finish it is imperative to exhaust the lacquer vapors and give the inner coating an air-drying before the kegs are baked.

The problem was solved by constructing parallel sets of wooden racks, each capable of supporting ten kegs. Between these racks was placed a standard blower, driven by a ¾-hp. motor, and exhausting to a stack. The intake side was connected to ducts beneath each of the racks, from which individual vacuum lines branch to the bungholes in the kegs.

After a keg has been sprayed and the excess lacquer drained by gravity, an overhead monorail conveyor swings it onto the rack and opposite a 1-in. nozzle which is inserted into the bunghole. A few minutes' operation of the blower is sufficient to draw air and vapor from the kegs and thoroughly dry the interior, after which they can be satisfactorily baked, outside and inside, at 300 deg. F. for 45 minutes.

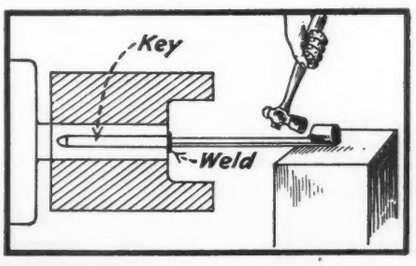
•

Removing Keyed Pulleys without Damage

E. J. WAGNER, *Lima, Ohio*

It is often necessary to remove a pulley from a motor or lineshaft, and it is sometimes difficult to do so without destroying the pulley. In most cases the trouble lies in the tightness of the key.

To take out the key, weld a piece



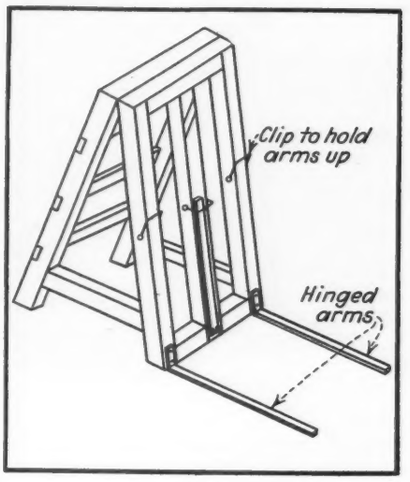
of bar iron 3 or 4 ft. long to one end of it. On the other end weld a block of iron, such as a short piece of shafting, about 2½ in. in diameter and 3 in. long.

If the "puller" is securely welded to the key and a rest is placed under the other end, the key can be drawn out by striking the iron block smartly.

Piling Rack for Metal Stampings

M. M. MILLER, *Baltimore*

Piling large stampings for ice refrigerators was a troublesome problem in our plant. Usually we piled them against a wall or any nearby post. They could never be placed at



a convenient location, and many needless steps resulted.

To improve this situation, a sturdy wooden rack resembling a stepladder was constructed. On one side were fastened three hinged arms which, when the rack is to be used, are unhooked and laid flat on the floor.

Stampings are placed on the arms and leaned against the rack. The pile need not stop at the end of the arms, but may extend many feet past. A small prong, placed on the bottom of the arms, will help to reduce slippage by imbedding itself in the floor. Thus, a greater piling load can be supported.

Slats were placed across the back of the rack to serve as ladder steps to upper racks in which more stampings can be piled.

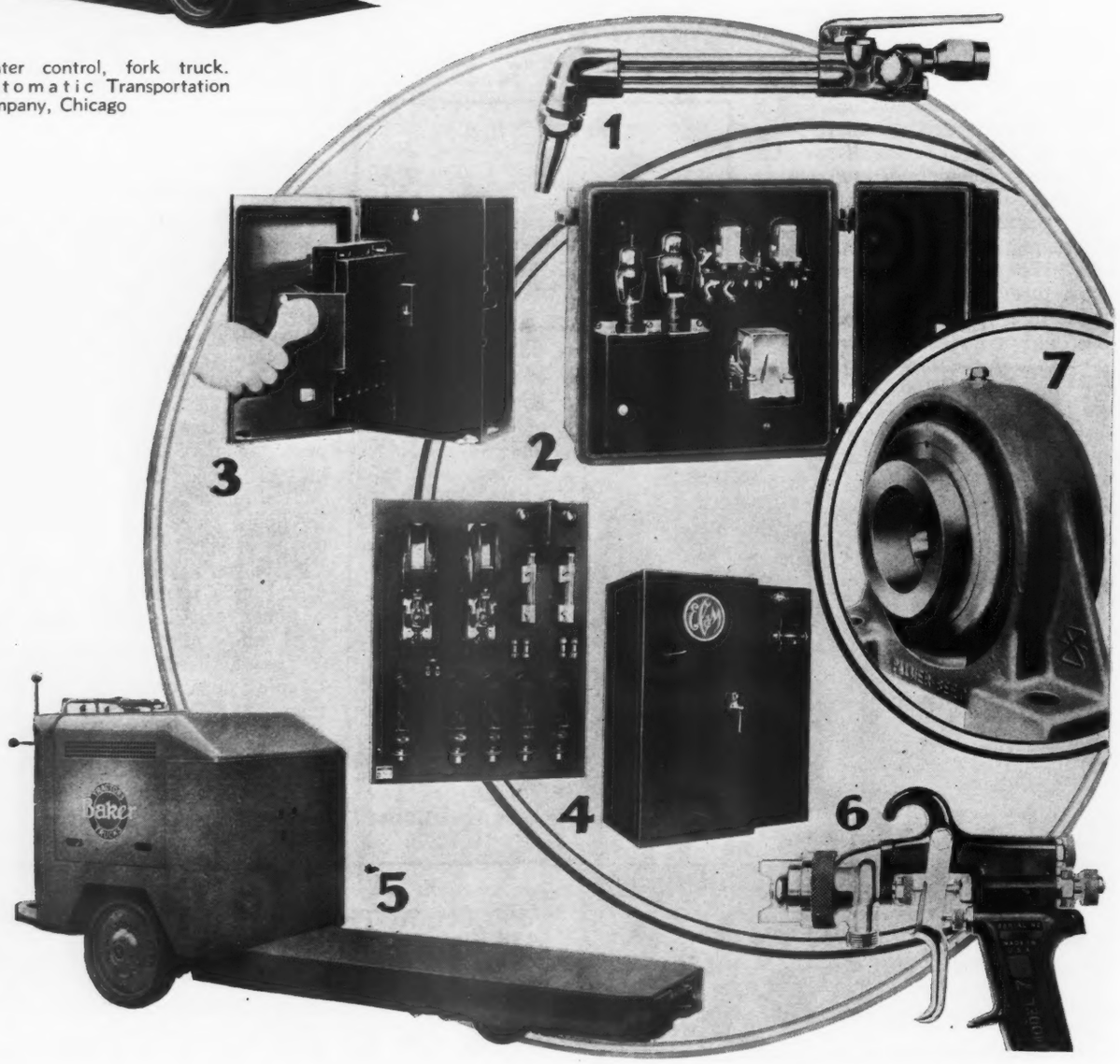
Use of these racks in our metal cleaning department has enabled the men to make their work quotas without difficulty, whereas previously the standards had been rather difficult to attain.

SPECIAL NOTICE . . . $10 will be paid for the best Operating Short submitted in the month of May. The Editors are the judges. Other Shorts will be paid for at attractive rates.

Flashes from the equipment makers

Center control, fork truck. Automatic Transportation Company, Chicago

1 Oxweld Type CW-22 cutting attachment. The Linde Air Products Company, New York
2 Protectoglo combustion-safeguard equipment. The Brown Instrument Company, Philadelphia
3 Swing-out switches. Square D Company, Detroit
4 Protective panels for electric cranes. The Electric Controller & Manufacturing Company, Cleveland
5 Elevating-platform truck. The Baker-Raulang Company, Cleveland
6 Thor Model 7 spray gun. Binks Manufacturing Company, Chicago
7 Pillow block. Palmer-Bee Company, Detroit



What's NEW in Equipment

Air Conditioning, Ventilating, Heating

AIR FILTER—Automatic impingement-type filter. Has two endless curtains, one dry and one running down into oil bath. Air flow strikes wet curtain first. Motor is 1/6 hp., 1,725 r.p.m., with a 400:1 reduction unit. Welded framework. Staynew Filter Corp., Rochester, N. Y.

AIR FILTERS—Glass filters for ventilating and heating systems and for engines and compressors. Have series of bonded mats and flexible glass fibers confined by metal grills and inclosed by fiberboard frame. Owens-Illinois Glass Co., Toledo, Ohio.

DUCT INSULATION — Balsam wood sound and heat insulation for ducts. Wood fiber mat treated to be fire-, moisture-, vermin-, and rat-resistant, is covered on each surface with Kraft liner. Wood Conversion Co., St. Paul, Min.

RETURN-AIR CONDENSER — Filters dust-laden air from pickers and nappers, collects the flocks, and returns dust-free air to room. Capacity is approximately 1,500 cu.ft. per min. Automatic and self-cleaning but for dust receptacle which must be emptied every 2 or 3 days. Knowlton & Newton Co., Inc.. Lowell, Mass.

UNIT HEATER—"Tex-Type," for use in lint-laden atmospheres. Constructed to reduce condenser clogging. Modine Mfg. Co., 1208 17th St., Racine, Wis.

UNIT HEATERS—Model FH. In capacities 191,000-802,000 B.t.u. per hr. based on 2-lb. steam and 60 deg. F. entering air temperature. For floor, vertical wall, or horizontal ceiling mounting. Nozzles can be adjusted for direction. Large diameter blowers operate at slow speed. Young Radiator Co., Racine, Wis.

UNIT HEATER, ELECTRIC—"Electromode Convection Heater." Rated at ¾ kw. Element is of cast aluminum construction. Completely insulated. Dimensions: 4½x9½x 16 in. American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind.

Bearings

BALL BEARINGS — Double-row, self-aligning ball bearings with double grease-shield protection. Correcting for 10-deg. shaft misalignment. Prepacked with lubricant. The Fafnir Bearing Co., New Britain, Conn.

BALL BEARINGS — Have single or double metal side-shields to retain lubricant and exclude dirt. Bore sizes range 4-110 mm.; outside diameters, 16-225 mm. Single- and double-row types. Fafnir Bearing Co., New Britain, Conn.

Building Materials

PITCH—Coal tar pitch for steep roofs. Manufacturer claims that it will withstand coldest winter weather without cracking, that it is resistant to slide at high temperatures. For use on inclines with slopes 2-6 in. per ft. The Barrett Co.. 40 Rector St., New York.

WEATHER STRIP—Made of MetaLane, an aluminum base metal. Manufacturer claims it will not tarnish and will resist corrosion. Resilient and hard wearing. Monarch Metal Weatherstrip Corp., 6333 Etzel Ave., St. Louis.

Electrical Control

MOTOR CONTROL CABINET—For motor controls located outdoors. Six rotary switches with key-type removable handles are mounted on hinged door. Louvers for ventilation and heating unit to prevent condensation. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

PHOTOELECTRIC CELL—"Electrocell." Dry-disk, self-generating type. Sizes 1-2§ in. in diameter. Sensitivity of 350 microamperes per lumen in 500 ohms external resistance. Dr. F. Loewenberg, 10 East 40th St., New York.

RELAY—Photoelectric relay using Visitron phototubes. Designed for use on 110-120 volt, 50-60 cycle circuit; available in other a.c. voltages and frequencies. With or without lens aperture. Steel cabinet housing. G-M Laboratories, Inc., 1731 Belmont Ave., Chicago.

STARTER — Across-the-line type. Type A-32 DF. Totally inclosed temperature overload relays. Rated 25 hp. at 440 and 550 volts, 15 hp. at 220 volts, and 7½ hp. at 110 volts. Allis-Chalmers Mfg. Co., Milwaukee.

STARTER INCLOSURES—Inclosures to accommodate across-the-line starters and circuit breakers for motors on steel rolling mill tables. Cast iron. Bonnell Electric Mfg. Co., Chambers St., Chicago.

SWITCH—Toggle switch. Mercury tube type. Tube is hermetically sealed. Rated 30 amp., 125 volts. Hart Mfg. Co., Hartford, Conn.

SWITCHES—Type C and General Purpose swing-out-interior switches. Base and operating mechanism can be swung out giving entire box area for bringing in conduit and wires. Ratings: 30 and 60 amp. Square D Co., Detroit.

Electrical Distribution

CUTOUT—For transformer secondaries. Can be attached to transformer studs or to secondary conductors in banked transformers. Rated 250 volts, 100 amp.; rupturing capacity 5,000 amp. W. N. Mathews Corp., St. Louis.

ELECTRICAL EQUIPMENT — A combined sales organization has been announced by the Roach-Appleton Mfg. Co.. South Bend, Ind., and All-Steel-Equip Co., Inc., Aurora, Ill. Products will be distributed by All-Steel-Equip. Co., Inc., 500 Kensington, Aurora, Ill.

PANELS — For electrically operated cranes. Protective panels incorporate all necessary protective devices in single unit. Have contactors, knife switch, receptacles for pilot lights, overload relays. Open style, completely inclosed, or front-inclosed. The Electric Conroller & Mfg. Co., 2700 East 79th St., Cleveland.

RECTIFIER—Manufacturer claims ±1½-volt accuracy when connected to constant a.c. source. Input: 60-cycle, 3-phase, 208-, 220-, or 240-volt a.c.; output; 50-volt, 5- or 10-amp. d.c. Metal inclosure. Ward Leonard Electric Co., Mount Vernon, N. Y.

TERMINAL BLOCK — Secondary Terminal block for current transformers. Conducting parts embedded in molded phenolic insulation. Design prevents tampering. Allis-Chalmers Mfg. Co., Milwaukee.

Electrical Protection Devices

CIRCUIT BREAKERS—Inclosed "De-Ion" Flipon circuit breakers for flush or surface installation on lighting or single-phase motor circuits. Ratings: 15 and 50 amp. Westinghouse Electric & Mfg. Co. East Pitsburgh.

LIGHTNING ARRESTERS — "Crystal Valve" glass and glass-porcelain composite arresters for voltages 1,000-15,000. Three-kva. unit has glass body and cap. Units for 6, 9, 12, and 15 kv. are of composite construction. Electric Service Supplies Co., North 17th St., Philadelphia.

Food

Freezer—Continuous freezer for ice cream. Freezing cylinder, dasher, motor, and accessories housed in compact unit. Direct-expansion, flooded ammonia system. Fruit feeder and mixer offered as accessory. Sizes: 60, 150, and 300 gal. per. hr. Package Mfg. Co., West Washington Blvd., Chicago.

SIFTER—For flour, sugar, and other dry materials. Three screens, 10, 12, and 14 mesh. Hopper capacity, 100 lb. Motor is ¼ hp. Portable. "Sift-All." Hinkle Machine Co., Hanover, Pa.

Grinding and Buffing

FLEXIBLE SHAFT GRINDER—"Bingo-Gl." Has ½-hp., 110-120-volt, single-phase, 60-cycle motor. Mounted on stand, including tool tray, casters, and shaft hangar. Swartz & White Mfg. Co., Binghamton, N. Y.

GRINDER—Osterholm horizontal grinder. Single machine for small production and tandem for high production. Linear feed of 12-72 in. per min. Dresser brackets for either star dresser or diamond fixtures. Williams, White & Co., Moline, Ill.

GRINDER—Type G824 surface grinding machine. Hydraulic longitudinal and cross feeds. Longitudinal speeds variable from 10 to 100 ft. per min. Two 1½-hp., 1,800-r.p.m. motors. Water pump and removable sediment tank. Grinds 8 in. wide, 24 in. long, 9 in. high. Diamond Machine Co., 9 Codding St., Providence, R. I.

GRINDER, TOOL AND CUTTER—Has universal fixture having adjustments in all directions. Grinding wheel reciprocated by ram. Wheel is mounted at front, motor at back, the two connected by a belt. Motor is ½-hp. Oliver Instrument Co., Adrian, Mich.

GRINDING OIL AND PASTE—For use with high production precision grinding machinery. Contain rust-inhibiting agent. Paste is fairly soluble in water. E. F. Houghton & Co., 240 West Somerset St., Philadelphia.

Instruments and Meters

COMBUSTION SAFEGUARD—"Protectoglo." Has flame sensitive electrode from which power is conducted to ground through flame. Has thermionic tube relays housed in dust- and moisture-proof cast iron cases. The Brown Instrument Co., 4461 Wayne Ave., Philadelphia.

FLUID METERS—Two types of Rotameter. Taper pole Rotameter for metering oils and semi-opaque liquids. Second type is designed for use in handling fluids that become viscous at or near room temperatures. Schutte and Koerting Co., North 12th St., Philadelphia.

GEAR SPEEDER—For testing gears for quietness by simulating operating conditions. Gears can be run together forwards and reverse. Each of two spindles has

own drive and brake. Single handwheel control. Michigan Tool Co., Detroit.

LIGHT-WAVE EQUIPMENT—For testing flatness of commercial lapped flat surfaces and dimensions of precision gage blocks, plug gages or steel balls. Has monochromatic light and two semi-quartz working flats. Van Keuren Co., Watertown, Mass.

LOW-PRESSURE GAGE — Test gage measuring 0-1½ lb. Calibrated from 0 to 35 in. of water and 0 to 20 oz. Bronze diaphragm. Fisher Governor Co., Marshalltown, Iowa.

METER—"Twin Multimeter," type 5012. Has 29 ranges. Can be used as d.c. instrument or as thermal meter for a.c. or d.c. Voltages up to 1,000. Rawson Electrical Instrument Co., Cambridge, Mass.

TEMPERATURE RECORDER—"Velarmeter." For recording temperatures of steel as it is being rolled. Measuring element is thermocouple which receives heat from steel through a lens. Bacharach Industrial Instrument Co., Pittsburgh.

TESTER, PAPER—For making folding endurance tests on paper. Reciprocating blade double-folds specimen between rollers until it breaks at crease. Has counter; motor stops automatically at point of rupture. Inclosed in cabinet. Amthor Testing Instrument Co., 10 Leo Pl., New York.

THERMOSTAT, HYDRAULIC—For air or liquid temperatures. Control knob with temperature readings can be located in any convenient exterior part of equipment. Hart Mfg. Co., Hartford, Conn.

VELOMETER—"Alnor" Boyle Velometer. Indicates directly on scale air velocities in feet per minute. Self-contained. Range 0-2,500 ft. per min. Illinois Testing Laboratories, Inc., North La Salle St., Chicago.

Lighting

LIGHTING UNITS—For inspection lighting. No. 1108-S designed for lighting long inspection and grading tables. No. 1108-C designed for inspection of small objects. Aluminum reflector. Holophane Co., Inc., 342 Madison Ave., New York.

MERCURY LAMP UNIT—No. 687 high intensity mercury lamp. Rated at 30 lumens per watt; life, 2,000 hours. Distribution is of intensive type. Removable aluminum cover. Holophane Co., Inc., 342 Madison Ave., New York.

Lubricants and Lubricating Devices

GREASE GUN—For applying grease to ball and roller bearings. Over lubrication is prevented by provision for relief and back pressure. "Keystone BB." Keystone Lubricating Co., Lippincott St., Philadelphia.

LUBRICATION GUNS—Electric and air-operated twin lubrication guns. Portable, with capacity of 40 lb. Will handle heavy and fibrous lubricants. Alemite Division, Stewart-Warner Corp., 1870 Diversey Parkway, Chicago.

Materials

PLASTIC—"77 SB Black." Molding material for parts where acid resistance, frictional-wear resistance, and low water absorption are required. Can be machined after molding. General Plastics. Inc., North Tonawanda, N. Y.

STEEL—"Armco H.T.-50." High-tensile steel. Low carbon so that it can be welded. Resists atmospheric corrosion better than ordinary steels. Sheets and plates made in 20 gage and heavier. American Rolling Mill Co., Middletown, Ohio.

Materials Handling

CONVEYOR, BELT—Has hollow rubber curbs vulcanized to sides of standard conveyor belt. Curbs prevent materials falling off. Curbs bend around all pulleys. Curbelt Co., Ltd., 231 St. James St., Montreal, Que.

TIRE FOR MONORAIL HOIST—Pneumatic rubber tire for monorail hoists is mounted so that it presses against bottom of overhead rail. Better traction, smoother starting, improved control claimed for it. American MonoRail Co., Athens Ave., Cleveland.

TRUCK—Elevating, fork truck. Capacity 10,000 lb.; forks 72 in. long. Center control and front-wheel drive. Will operate in 84-in. intersecting aisles. Center control position is a safety feature, providing protection for operator. Automatic Transportation Co., 39 West 87th St., Chicago.

TRUCK—No. 1595 "Q" type floor truck. One-piece welded steel frame. Hardwood tops steel-bound all around. Balloon tires. Roller bearings. Lewis-Shepard Co., Watertown Station, Boston.

TRUCK, LIFT—Model L. Fork, ram. or scoop equipment. Capacity 4,000 lb. Gasoline operated. Lifting, tilting, and scooping operation are controlled hydraulically. Speeds for lift or travel furnished to meet plant requirements. Towmotor Inc., East 152d St., Cleveland.

TRUCK, LIFT—"Red Junior." Spring handle holdup prevents handle from falling to floor. Single-stroke lift; lift from an angle. For loads 500-2,500 lb. Model J is 17⅜ in. wide, Model JK 23⅜ in. Barrett-Cravens Co., 3250 West 30th St., Chicago.

TRUCKS, LIFT—Vertical lift type. Type EV-3 has capacity of 6,000 lb. and chain type elevating unit. Type EX-2 has capacity of 4,000 lb. and screw-and-nut type elevating unit. Bumper nose and pin-type coupler. Platform is 55x26¼ in. The Baker-Raulang Co., 2178 West 25th St., Cleveland.

TRUCKS—Platform hand trucks. "Service Push-EZ." Two sizes: 4,000 and 6,000 lb. when equipped with steel wheels. With rubber or Textolite wheels capacities are 2,000 and 2,500 lb. Five platform sizes. Service Caster & Truck Co., 505 North Albion St., Albion, Mich.

Mechanical Power Transmission

CLUTCH-BRAKE — Style E. Combination magnetic clutch-brake developing clutch torque of 4,500 lb.-ft. and brake torque of 1,500 lb.-ft. Brake is spring-actuated. Magnetic Mfg. Co., Milwaukee.

COUPLING — L-R Type "W" flexible coupling. Load cushions are free floating between metal jaws. Three types of cushioning material. Standard sizes with bores from 3 to 14 in. Lovejoy Tool Works, 4963 West Lake St., Chicago.

PILLOW BLOCK — Self-aligning. For light or heavy shock loads at high or low speeds. Dirtproof and dustproof cast steel housing. All standard sizes. Palmer-Bee Co., Detroit.

SPEED REDUCERS — Planetary speed reducers. Ratio from 20:1 to ∞:1 are available. Winfield H. Smith, Inc., Springville, Erie Co., N. Y.

VARIABLE SPEED TRANSMISSION—"Oilgear." Redesigned model, eliminating parts in input and output units. Output speeds, 5-1,090 r.p.m. Sizes, 2-100 hp. Manual or automatic operation. Oilgear Co., Bruce St.. Milwaukee.

Metal Finishing

SPRAY GUN—Thor Model 7. For fast production work. Gun body is of drop forged aluminum with black electrolytic coating. Binks Mfg. Co., 3114 Carroll Ave., Chicago.

Metal Working

AUTOMATIC SCREW MACHINE—Improved design of No. OOG high speed, motor-driven machine. Has 36 spindle speeds from 200 to 6,000 r.p.m. Handles material up to ⅝ in. in diameter (¾ in. on light work). Metal plates with diagrams and charts of speed variations and gear combinations are mounted on machine. Brown and Sharpe Mfg. Co., Providence, R. I.

CURLING MACHINE—For curling ends of round tanks over end stampings. Horizontal, double- and single-end machines. Capacity is for tanks 12-18 in. in diameter, up to No. 14 gage Monel metal. Motor is 7½ hp. Stationary headstock and adjustable tailstock. Peck, Stow & Wilcox Co., Southington, Conn.

CUTTING-OFF MACHINE — "Tabor-Brasive." Table height is easily adjusted; table is made in two halves so that odd shapes can be worked. Air-cooled, inclosed motor. Four types ranging from stationary head and table to traversing head and variable table. Tabor Mfg. Co., Tacony St., Philadelphia.

CUT-OFF MACHINE—Abrasive cut-off machine for plastic rods and bars. Hand- or foot-operated. Cuts soft materials up to 2½ in., but may be used for small sizes of steel, either dry or under water. White Engineering Laboratories, Inc., Paterson, N. J.

CUT-OFF MACHINE — Universal abrasive cut-off machine. Chop-cut stroke. draw-cut stroke, or combination of the two. Cuts at any angle. Manufacturer claims that cut is clean and smooth and to close accuracy. Bethlehem Foundry and Machine Co., Bethlehem, Pa.

DRILLING MACHINE—Horizontal drilling machine with automatic hydraulic operating cycle. Twenty-three cutting tools operate simultaneously. Five-station fixture in which two work-holding heads are mounted. Central pushbutton station. Two motors. Rockford Drilling Machine Co., Rockford, Ill.

DRILLING MACHINE — Sliding head. Direct-connected, 1,200-1,800-r.p.m. driving motor. Sizes: 21, 25, and 30 in. Nine feeds from 0.005 to 0.045 in. Twelve spindle speeds in ranges 50-1,000 or 75-1.500 r.p.m. Cleerman Machine Tool Co., Green Bay, Wis.

FURNACE, ELECTRIC—Air tempering furnace giving temperatures up to 1,200 deg. F. Metal lined. Fan circulates air around baffle construction. Foot-operated door opening mechanism. Door remains stationary in any position. Inside dimensions, 18x13x30 in. Cooley Electric Furnace Co., East 20th St., Indianapolis.

FURNACE, ELECTRIC—"H." Rated at 14 kw., 230 volts, single-phase. Working temperatures up to 1,850 deg. F. Inside dimensions 12x9x24 in. Door is lifted by treadle, and chain can be locked in any position. Harold E. Trent Co., 618 North 54th St., Philadelphia.

GEAR SHAPER—Uses gap-type cutter for rough and finish cutting of external spur and helical gears in one operation. Regular cutters can also be used. Motor drive and automatic electrical control. Constant-speed motor, motor starter with thermal overload protection, pushbutton control. Fellows Gear Shaper Co., Springfield, Vt.

GRINDER, LATHE — No. 44 "Toolmaker." For internal and external grinding. Has ¼-hp. motor, spindle speeds of 7,000-44,000 r.p.m. Can be mounted on lathes with 8-in. and greater swing. Dumore Co., Racine, Wis.

LATHE—Model DA-8 automatic, duplex crankshaft lathe, Designed especially for machining heavy diesel-type and tractor-type crankshafts. After chucking, pressure on pushbutton sets machine going and no other manual operation must be performed until cycle has been completed. Wickes Bros., Saginaw, Mich.

LATHE — Series "N" Underneath Belt Motor Driven Lathe. For production work, tool room. or general machine shop. Motor drive mechanism inclosed in cabinet leg under headstock. Double wall apron, multiple-disk friction feed clutch. V-belts. Reversing 1,200-r.p.m. motor. South Bend Lathe Works, South Bend, Ind.

NEW Equipment · Machinery · Materials · Supplies

LATHE, BENCH—"Cataract." Electrical driving unit with 6 forward and 6 reverse speeds 230-2,500 r.p.m. Second unit has 8 speeds 230-3,900 r.p.m. Five sizes ranging in spindle capacity from ½ to 1 in. and in swing over belt, 7-9 in. Hardinge Bros., Inc., Elmira, N. Y.

METAL SPRAY GUN—For use in applying lower melting alloys. One-hand operation. Manufacturer claims spraying up to one pound of solder per minute. Advance Engineering Corp., Duncannon, Pa.

MILLING MACHINE—Horizontal, two-way opposed hydraulic-feed face milling machine for simultaneous milling of opposite sides of castings. Cutters up to 12 in. maximum diameter can be used. Heads are V-belt driven. Control can be adjusted to give feeds from 1½ to 40 in. per min. Defiance Machine Works, Defiance, Ohio.

MILLING MACHINE—No. 4 drum-type machine. Work drum housing slides on support for adjustment to work. Work drum is located on work mandrel, 22 in. in diameter. Motor to worm gearing directs feed. Drive to spindles is through worm and worm gearing. Overarm support, 16 in. in diameter. Davis & Thompson Co., Milwaukee.

MOLDING MACHINE — For foundries. Has 20-in., power jar, hand roll, foot draw. Double guide for heavier loads. Four-point leveling device. Operated by quick-acting gate valve. Tabor Mfg. Co., Tacony St., Philadelphia.

PLANER — "Hy-Draulic." Hydraulic power reciprocates machine table. Hydraulic pressure used for feeding all heads. Motor directly connected to hydraulic power unit. Maximum pull to table is 24,000 lb. Length of bed may be had from 23 to 45 ft., length of table 12-22 ft., width of table 36-42 in. Cutting speeds of table range 0-50 ft. Rockford Machine Tool Co., Rockford. Ill.

PRESS—A 75-ton press for forcing bushings in or out, and for forming small parts. Controlled by single valve lever. Hydraulic pressure furnished by rotary, motor-driven pump. Safety valve prevents overloading. Baldwin-Southwark Corp., Philadelphia.

PRESS — "Hyspeed" 500-ton hydraulic press. For pressing parts from hot steel, forging, forming. Fifteen strokes per minute. Motor-driven rotary piston pump and oil tanks mounted on top platen. Accurate die setting possible; also close control of platen stroke. Baldwin-Southwark Corp., Philadelphia.

PRESS BRAKE—Bends materials up to 16 ft. long; capacity is 500 tons. In operation it pulls two leaves together instead of pushing one down. Driving mechanism is installed below floor level. Welded steel construction. Powered by 30-hp. motor; operation is 2-speed, 4 or 20 strokes per min. Boom Boiler and Welding Co., Cleveland.

RINSING AND DRYING EQUIPMENT—For plated work. Work is charged into rinsing drum from hopper. Perforated cylinder rotates in hot water. Rinsed material is moved by worm to drying screen where it drains before being subjected to hot air blast. N. Ransohoff, Inc., Cincinnati.

RIVETER — Electric hydraulic riveter. Oilgear fluid power pump direct-driven by electric motor through flexible coupling. At maximum pressure of 3,000 lb. per sq.in. it exerts 80 tons on dies. Available in capacities of 20, 40, and 60 tons. Hanna Engineering Works, Elston Ave., Chicago.

WIRE TWISTER — For twisting wires about reinforcing rods and for other twisting operations. One end of wire is held while other is bent around rods. Free end is then inserted in second notch of twister. twisted, and both ends released. M & M Wire Clamp Co.. 17th Ave., S.E., Minneapolis.

Miscellaneous

CHAIR — Constructed of 1-in. tubular-steel with seat supported on square, cold rolled steel spindle. Tapered keyway permits instantaneous adjustment of seat height. Harter Corp., Sturgis, Mich.

DEMAGNETIZER AND ETCHER — Placed over magnetized heavy tools or dies, it demagnetizes them. Etching pencil has three jack stages to prevent burning thin pieces. Pieces down to about 0.015 in. thickness can be etched. Frampton Electrical Equipment Co., Norwood Bldg., Dayton, Ohio.

DEVELOPING MACHINE—For positive type prints with black, blue, or maroon lines. No negative required. Developing agent consists of ammonia fumes. Develops sensitized paper or cloth 36, 42, and 54 in. wide at rate of 18 in. per min. Ozalid Corp., 354 Fourth Ave., New York.

DRAFTING MACHINE — "Wrigraph" Model E-272. Mounted on 22x30-in. cleated, white pine board. Parallel mechanism, vernier indicating protractor. L. G. Wright, Inc., 5713-2 Euclid Ave.. Cleveland.

DRAWING BOARD TOP—Designed to eliminate necessity of inking drawings before blueprinting. Are glued to board top and drawing paper is laid on directly. Double stroke of pencil causes lead to be deposited in depression so that a clear line, which will not smudge, results. W. H. Long Co., North Clark St., Chicago.

KETTLES — Electrically heated process kettles for oil treating. and for food and chemical process work. Sizes: 100, 250, 500, and 1,000 gal. Made of stainless steel, aluminum, or other metals. Automatic control. Patterson Foundry & Machine Co., East Liverpool, Ohio.

OIL SPRAYER—Pressure oil sprayer for oiling foundry floors. Tank is carried on operator's back while pump is operated by lever held in right hand. Left hand holds brass extension rod to which spray nozzle is attached. Mekeel Engineering Co., West State St., Milwaukee.

PUMP—For molten sulphur. Dual unit. Pumping unit and check valves are submerged in the sulphur. Delivery rate can be adjusted during operation. Hills-McCanna Co., Nelson St., Chicago.

SLIDE RULE—"Apex." Circular. Has all regular scales and several special ones. Diameter is 8¼ in. Gilson Slide Rule Co.. Stuart, Fla.

VACUUM CLEANER—Has double fan, ¾-hp. motor, and 1½-in. hose. Bag is double. Mounted on two rubber-tired wheels and swivel caster. Special tools. Kent Co., Inc., Rome, N. Y.

VAPOR SPRAY CLEANER—"Model G Hypressure Jenny." Combination of water vapor, hot water, and cleaning chemicals applied to surfaces to be cleaned at pressures from 50 to 150 lb. per sq.in. Stationary and portable models. Homestead Valve Mfg. Co., Coraopolis, Pa.

WEB TENSIONING MACHINE — Provides uniform tension on web of fabric or paper while it is being unrolled. Tension can be maintained regardless of change in speed of slitter or press. For light or heavy materials. Cameron Machine Co., 61 Poplar St., Brooklyn, N. Y.

Packaging

BARREL PACKER—Vibrator with oscillating flat platen upon which barrel rests. Amplitude of vibration varied by means of rheostat. In seven sizes for packages from 50 to 800 lb. Operates on a.c. line. Jeffrey Mfg. Co., 911-99 North Fourth St., Columbus, Ohio.

DRUMS — Latex coated, fiber drums. Solid, seamless fiber body is coated with vulcanized latex composition. Pliofilm seal is used as additional protection around cover. Suitable for solids and semi-liquid materials. Pull-out ring. Sizes up to 60 gal. Carpenter Container Corp., Brooklyn, N. Y.

Piping, Valves and Fittings

STEAM TRAP—Improved design of Type AE has redesigned discharge valve. Working pressures up to 200 lb., except for smallest trap which takes up to 150. Capacities 300-18,000 lb. per hr. Stickle Steam Specialties Co., Indianapolis.

VALVE—"K-10" magnetic valve. For water, gas, oil, steam. Operates on pressures up to 300 lb. on small port openings. Packless. Consumes 14 watts. Made of brass and stainless steel. General Controls Co., Harrison St., San Francisco.

VALVE CONTROL—Remote valve control to supplement automatic control systems. Operator can make change in position of remote valve as small as ¼ in. of water. Foxboro Co., Neponset Ave., Foxboro, Mass.

Power Plant Equipment

AFTERCOOLER—"PL Cooler" for air and gas compressors of moderate capacity. Placed in discharge line. Has large number of small diameter tubes cooled by counter-current flow of water. Moisture-separating chamber reduces velocity of air. Ingersoll-Rand Co., 11 Broadway, New York.

COAL SCALES — Automatic scales for weighing coal to stokers or pulverizers in small boiler installations. Hopper capacities: 50 and 100 lb.; hourly ratings: 2-3 tons and 4-6 tons. Open type for weighing to stokers and closed type for weighing to pulverizers. Richardson Scale Co., Clifton, N. J.

COMPRESSED AIR DRYER — Consists of contra-flow aftercooler, centrifugal expeller to remove condensed water and oil from cooled air, automatic drain trap. Sizes 40-300 cu.ft. per min. Ruemelin Mfg. Co., North Palmer St., Milwaukee.

CONDENSATE RETURN UNIT — Returns steam and condensate to boilers at high temperatures. Device is single piece of equipment. One moving part. American District Steam Co., North Tonawanda, N.Y.

DIESEL ENGINE — Model VL. Solid-injection unit for 100-200 hp., stationary service, at 900 r.p.m. Up to 240 hp. at 1,200 r.p.m. Four-cycle, 4, 6, or 8 cylinders, 7x8 in. C. I. removable liners and aluminum-alloy pistons. Pressure lubrication. De LaVergne Engine Co., Philadelphia.

DIESEL GENERATOR SETS — Model GA Superior. Delivers 10-50 kw. at 1,200 r.p.m. Solid injection; 2, 4, or 6 cyl., 4½x5½-in.; 4-cycle. Pressure lubrication. Electric starting. Exciter for a.c. units. Single-lever control. Otto Engine Works, Holmesburg, Philadelphia.

FILTER — Combination honeycomb tube and carbon cartridge. Removes tastes and odors from water by absorption. Capacity, 1 gal. per min.; sizes up to 60 gal. per min. available. Pressures up to 150 lb. Commercial Filters Corp.. 89 Broad St., Boston.

HYDRAULIC PRESSURE BOOSTER — Designed for testing applications. Has two cylinders, one low pressure and one high pressure. Pressures can be built up to 5,000 lb. at slow steady rate, or rapidly. Martin-Decker Corp., Long Beach, Cal.

PUMP—Small roller pump has hardened stainless steel rollers which act as pistons. Self-priming. Cylinder heads may be removed for cleaning without disturbing pipe connections. Maximum suction lift wet is 27 or 28 ft. Hercules Equipment and Rubber Co., San Francisco.

PUMPS, CENTRIFUGAL—Series "5,000." Volute case and open-type impeller. Impeller may be adjusted while pump is in operation; adjusting nuts on each side of ball bearings. The F. E. Myers and Bro. Co., Ashland, Ohio.

REFRIGERATING UNIT—"Ice Engine." Operates on manufactured or natural gas. Watercooled. Each unit built especially

with reference to heat value of fuel to be used. Automatic control. Waukesha Motor Co., Waukesha, Wis.

Rubber Working

BALE CUTTER — Cuts various shape bales of crude rubber. Does not require use of water or lubricant. After knife-operating lever has been tripped, knife makes cut and returns to starting position. The Black Rock Mfg. Co., Bridgeport, Conn.

PLASTICATOR—Hot breakdown of rubber in two stages. Rated at 10,000 lb. per hr. with horsepower of 625-650. Jacket circulations give close control of temperature. Rubber is extruded at 365 deg. F. Size: 20-in. Farrel-Birmingham Co., Inc., Ansonia. Conn.

Safety Equipment

LEG SPLINT—Leg splint especially designed to allow industrial first aid workers to care for broken legs. Weighs 7½ lb. Davis Emergency Equipment Co., Inc., 55 Van Dam St., New York.

Sanitation

SOAP DISPENSER—Powdered soap dispenser for use on group wash-fountains. Made of translucent glass. Top, base, support, and push-up valves are chromium plated brass. Bradley Washfountain Co., Milwaukee.

TOILET PARTITIONS — "Porcena" Toilet Partitions. Consist of flush-type, insulated partition panels, porcelain enameled on both sides, with doors finished in plain baked enamel. Colors or imitation wood grain finishes. Sanymetal Products Co., Inc., 1699 Urbana Rd., Cleveland.

WATERCOOLER — Has Frigidaire "meter-miser" unit. Bottle and pressure types. Half-gallon storage reservoir; 7-pt. drip basin and receiver of aluminum alloy. Thermostatic switch with cold control. Frigidaire Corp., Dayton. Ohio.

Textile

KNITTING MACHINE—Number of feeds ranges from 17 on 15-in. model to 26 on 23-in. model. Stroboscopic instrument is incorporated in machine to measure speed of yarns accurately and insure uniform feeding to knitting heads. Latch needles are used, producing a symmetrical stitch. Hemphill Co., Pawtucket, R. I.

KNITTING MACHINE—"PR" machine produces jacquard-type patterns on both face and back of rib fabric. Knits goods up to about 48 needles wide by 64 courses deep at rate of 60-70 yd. per 8-hr. day. H. Brinton Co., Kensington Ave., Philadelphia.

LOOM—Woolen and worsted looms convertible from 4x1-box automatic to 4x4-box pick-and-pick non-automatic, or vice versa, in 30 min. Type W-2 has 20 harnesses, type W-3 26 harnesses. Crompton & Knowles Loom Works, Worcester, Mass.

RAW SILK GRADER — "Evenometer." Employs photoelectric cell for grading and recording evenness quality of raw silk. Reveals differences of lots having same denier size but different average diameter sizes. United States Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.

SHUTTLE EYE — Rear-tension shuttle eye for automatic rayon shuttles. Made for both adjustable- or stationary-type tension. Watson-Williams Mfg. Co., Leicester, Mass.

TWISTING RING — Self-lubricating. Lower section is grooved and carries wick for oil. Upper section carries tail plate and is clamped on lower half. Steel Heddle Mfg. Co., Atlanta.

Tools and Supplies

KNIFE — Shop knife with a variety of uses. Has 6 replacement blades in handle. Bonney Forge & Tool Works, Allentown, Pa.

PACKING COMPOUND—"Copalit" packing and insulating compound for cylinder heads, fittings, boilers, etc. In diluted form, called "Rustnil" for painting and spraying on metal surfaces to prevent rust and resist corrosion. National Boiler Improvement Co.. Georgia Ave., Washington, D. C.

RULE—Steel tape, 6 ft. long. In case with 3 flat edges. Available in metric units. "Mezurall." Lufkin Rule Co., Saginaw, Mich.

SCRAPER — Has 48-in. wood handle, malleable iron casting, and tempered 4x6-in. spring steel blade. Blade is clamped in casting. "DeLuxe" scraper has larger casting providing foothold and taking larger blades. JKL Mfg. Co., Rockford, Ill.

SCREWDRIVER, ELECTRIC—Drives all sizes of screws from No. 4 to No. 12. Free speed, 700 r.p.m.; weight complete, 3¼ lb.; length overall, 10¼ in. "Thor U16." Independent Pneumatic Tool Co., 606 West Jackson Blvd., Chicago.

SOCKET WRENCH HOLDER — Molded rubber composition base with separate holder for each wrench. Two sizes: one accommodates 11 wrenches in sizes ⅜-§ in.; other accommodates 8 wrenches over same range. The Cleveland Universal Jig Co., St. Clair Ave., Cleveland.

STATOR WINDING TOOL — Stator Winding "Gun." Wire slips through "gun" from breech to muzzle. Pressure on trigger holds wire tight. Wire is laid in groove by hand, then pulled tight with tool. P. E. Chapman Electrical Works, 1820 Chouteau Ave., St. Louis.

Welding and Cutting

ELECTRODE — "Fillet-Craft." Heavily coated semi-slag shielded electrode, used with straight polarity. Produces concave fillet welds of smooth appearance. J. D. Adams Co., Indianapolis.

ELECTRODES—Series of three for welding high-carbon and low-alloy steels of high tensile strength. Presence of ferro-alloys gives high physical properties. "Red Devil." The Champion Rivet Co., Cleveland.

ELECTRODE HOLDER—K-5 and K-10 holders with grooved jaws for gripping electrode at various angles. Vulcanized fiber handle. Craftwell Equipment Corp., 250 West 54th St., New York.

ELECTRODE HOLDER — "Simplex." Especially for a.c. welding. Has capacity of 1/16-¼-in. electrodes, 300 amp. One type with soldered connection, one with quickly removable connection. The Fibre-Metal Products Co., Chester, Pa.

WELDER—Flash welder handling up to 20-gage sheets. Takes sheets 20 in. wide. Rated at 200 kva. Manufacturer claims that it will do same kind of work as done by large automobile body welders. Federal Machine & Welder Co., Warren, Ohio.

WELDER—P&H Hansen Model W-150. Capacity, 150 amp. Bare or coated electrodes, 3/32-3/16 in., can be used. Drive by electric motor or gasoline engine. Harnischfeger Corp., 4525 West National Ave., Milwaukee.

WELDING CUTTER ATTACHMENT—Oxy-acetylene cutting attachment for light sheet metal and heavy work. Operates on low- or medium-pressure acetylene. "Oxweld Type CW-22." The Linde Air Products Co., 30 East 42d St., New York.

Wire and Wiring Devices

CONNECTORS—Solderless. For Nos. 14, 16, and 18 solid and stranded wires. Molded case provides insulated outer covering for machined brass tubing which holds conductors. G & R Electric Co., Wilkinsburg, Pa.

TAP—"Hottaps," a device for rapid connections to distribution line when line is either alive or dead. Weight of suspended cable helps to hold clamp on line. Six sizes. Burndy Engineering Co., 305 East 45th St., New York.

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TRADE LITERATURE

Aftercooler—Folder, describing PL aftercooler for air or gases.—Ingersoll-Rand Co., 11 Broadway, New York.

Air Conditioning—Bulletin 1119, showing air conditioning installations.—Carbondale Machine Corp., Harrison, N. J.

Air Conditioning Cabinets—Bulletin 501, on Type "PC" cabinets for air conditioning.—Buffalo Forge Co., Buffalo, N. Y.

Air Filter—Bulletin No. 120, on Model A air filter for ventilating purposes.—Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.

Ball Bearings—Bulletin No. F-951, on Cartridge type ball bearings.—Norma-Hoffmann Bearings Corp., Stamford, Conn.

Bearing Units—Catalog No. 1520, on anti-friction bearing units.—Link-Belt Co., 307 North Michigan Ave., Chicago.

Boiler Tubes—Booklet, title "Seven Facts about Boiler Tubes."—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Boring Machines—Bulletins PB-136 and PB-1035, on BET precision machines for boring, facing, and turning.—Ex-Cello-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit.

Castings—Bulletin No. 36, showing products of the American Brake Shoe and Foundry Co., 230 Park Ave., New York.

Compressor—Bulletin No. 172, on Class 3-ATC Oilfreair compressor.—Pennsylvania Pump & Compressor Co., Easton, Pa.

Compressors—Leaflet 2218, on "Ro-Twin" air compressors. — Allis-Chalmers Mfg. Co., Milwaukee.

Crushers—Catalog 621, on single roll crusher; bulletin No. 622, on double roll crushers.—The Jeffrey Mfg. Co., Columbus, Ohio.

Electrical Fittings—Revised Catalog No. 10, on threaded and no-thread Unilets; bulletin No. 1021, on outlet and switch boxes.—Appleton Electric Co., 1701 Wellington Ave., Chicago.

Electric Screwdriver—Folder, on Thor electric screwdriver.—Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago.

Fire Extinguisher—Pamphlet, on Lux fire extinguisher.—Walter Kidde & Co., 140 Cedar St., New York.

Flexible Coupling—Leaflet, on L-R Type "W" flexible coupling.—Lovejoy Tool Works, 5009 West Lake St., Chicago.

Flexible Shaft Outfit—Leaflet, announcing Bingo-G-1 flexible shaft machine and accessories.—Swartz & White Mfg. Co., Binghamton, N. Y.

Grinding Wheels—Catalog, on line of grinding wheels.—Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago.

Heat Exchangers—Booklet, on diesel exhaust gas and jacket water heat exchangers.—The Sims Co., Erie, Pa.

Iron Cement—Booklet, containing descriptions and prices of Smooth-On iron cements.—Smooth-On Mfg. Co., 568 Communipaw Ave., Jersey City, N. J.

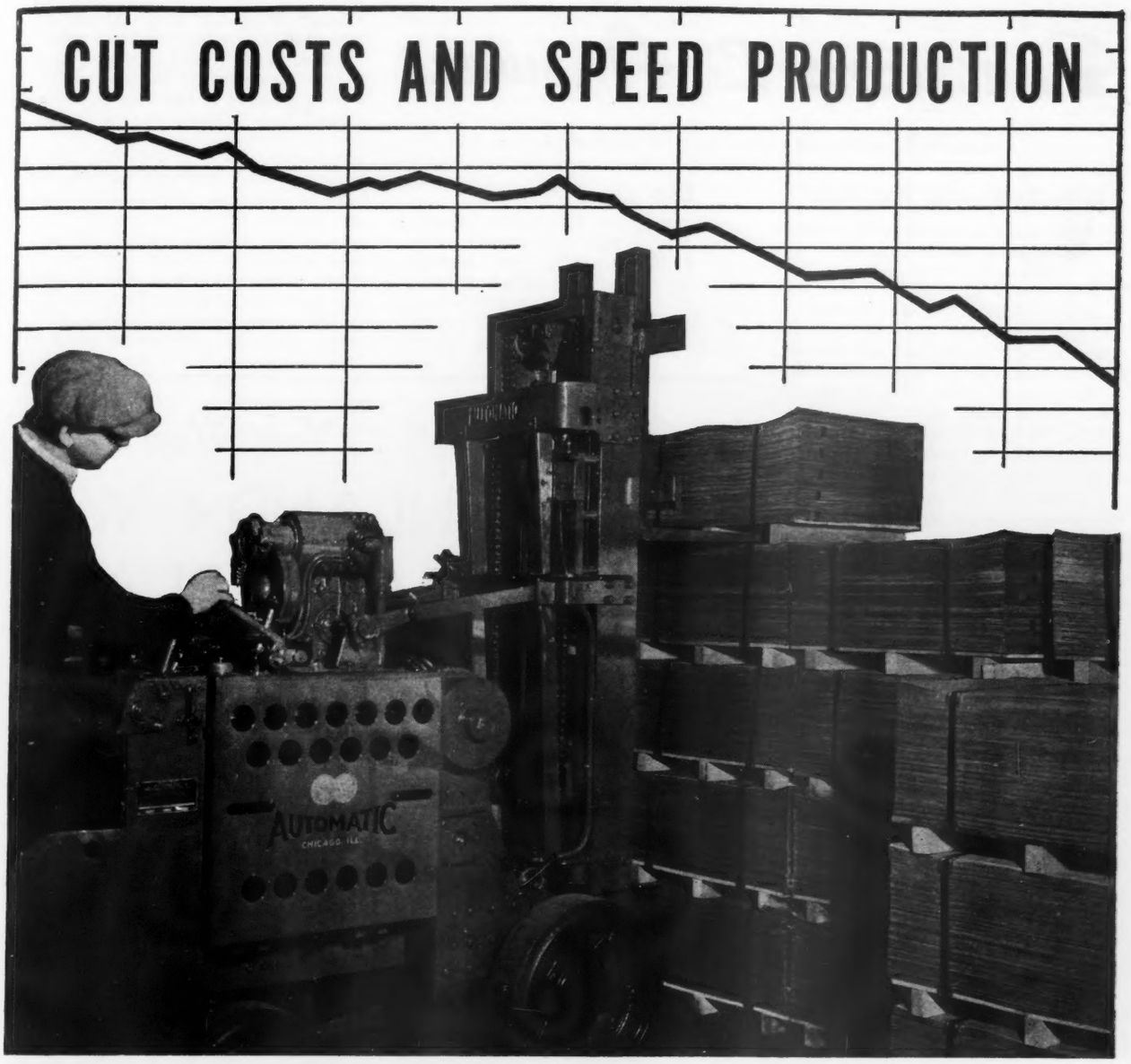
Lathes—Bulletin No. 100, on Series "N" Underneath Belt Motor Lathes.—South Bend Lathe Works, South Bend, Ind.

Lift Trucks—Bulletin No. 112, on Red Junior lift trucks.—Barrett-Cravens Co., 3250 West 30th St., Chicago.

(Continued on advertising page 58)

NEW Equipment · Machinery · Materials · Supplies

CUT COSTS AND SPEED PRODUCTION



WITH EXIDE-IRONCLAD BATTERIES

The speedy handling of material will cut production costs. Thousands of plants, in various lines of business, have found that electric industrial trucks equipped with Exide-Ironclad Batteries move material quickly and economically.

This equipment has almost unlimited power when needed. Acceleration is swift and smooth, while good speeds are maintained throughout the entire day's operation. Fire hazard is minimized, and maintenance requirements are almost negligible.

Exide-Ironclad Batteries assure uninterrupted service. Their high power ability, high electrical efficiency, extreme ruggedness and long life provide an outstanding combination of performance and economy.

Write for new, free booklet, "The Efficient, Economical Method of Handling Material."

Exide
IRONCLAD
BATTERIES
With Exide **MIPOR** Separators
"MIPOR," Reg. U. S. Pat. Off.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

★ Truck illustrated made by Automatic Transportation Company, Inc.

Questions & Answers

CONDUCTED BY G. A. VAN BRUNT

Is Profit Sharing Prevalent?

To what extent is profit sharing prevalent in industry today?

TRUE profit sharing in industry is usually defined as distributing to employees, on some basis not directly connected with individual performance, such as total annual earnings, a share in the general profit of the firm for some period such as a year. Profit sharing in this sense enjoyed considerable popularity about 15 or 20 years ago, but interest in it has declined.

Sharing of profits, with no direct relation to the individual employee's contribution to these profits, squares well with that sense of partnership in a common enterprise which most employers feel toward their men. It tends to build up a similar attitude of friendliness on the part of the men and, in the experience of various firms, tends to make the men careful of the company's interests in such things as the waste of material. On the other hand, any increased effort on the part of the employee toward increasing company profits and thereby his own earnings, is so diluted by various factors and the work of others that the value of profit sharing as a stimulus to production is usually negligible. With the improvement of the technique of studying and standardizing jobs, profit sharing has tended to give way to plans of payment in which the man's earnings depend on his performance in comparison with a carefully measured standard of output.

With routine work, output may be measured solely in terms of production of acceptable quality. In the case of more complex tasks, such as the running of a department, the measure of performance may be the actual as against the standard cost of operating the department. Some of the plans now called profit sharing are in reality savings sharing plans, as distinguished from the old, true use of the term.

It is reported that one employer, irked by certain features of the new tax laws, has instituted, at least for a time, a profit-sharing plan of the old type. The employee earns his regular rate plus a bonus whose amount depends on the profits of the firm for the preceding month.

Another corporation, one of the largest in the country, has just announced a bonus to employees in the form of a flat amount to each, bearing no relation to productivity. It is possible that with improving times and a less worried attitude on the part of employers we may see other revivals of the profit sharing, or arbitrary bonus, idea. —EDITOR.

How Clean Oily Belts?

Some of our leather belts, single and double ply, and ranging from 3 to 10 in. wide, have become pretty well soaked with lubricating oil. I have always understood that this is bad for them. What is the best way of cleaning these belts? Probably they should be washed in gasoline. Is some other solvent better? Will they need any other treatment? How can one tell when cleaning in this way is necessary? —P.L.R.

NUMEROUS cleaning agents, such as gasoline, naphtha, kerosene, and carbon tetrachloride are recommended for washing leather belts.

Immerse the loosely wound coil, placed on edge, in the liquid and allow to stand over night. Then stand on the other edge for ten hours. If the belt is dirty in addition to being oil-

The Inland 4-Way pattern with projections centering one another at right angles gives 4-Way traction for feet and wheels. It matches four ways—drains and sweeps clean four ways. The projections overlap reinforcing one another giving extra stiffness and strength.

Made with three different size projections in a full range of widths and thicknesses. Write for complete data.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, Cleveland, Cincinnati, Detroit, Boston, Buffalo, St. Louis, Philadelphia, Jersey City

RYERSON

Ryerson stocks also include everything in steel and allied lines.

BEAMS AND HEAVY STRUCTURALS
CHANNELS, ANGLES, TEES AND ZEES
RAILS, SPLICES, SPIKES, BOLTS, ETC.
PLATES—SHEETS
STRIP STEEL, FLAT WIRE
STAINLESS STEEL
HOT ROLLED BARS—HOOPS AND BANDS
COLD FINISHED SHAFTING SCREW STOCK
COLD FINISHED FLATS
ALLOY STEELS—TOOL STEELS
HEAT TREATED ALLOY STEEL BARS
BOILER TUBES AND FITTINGS
WELDING ROD—MECHANICAL TUBING
RIVETS, BOLTS, NUTS, WASHERS, ETC.
REINFORCING BARS
BABBITT METAL AND SOLDER

soaked, the dirt usually loosens and settles to the bottom. Dirt that does not loosen and settle can usually be removed by brushing or scraping. Leather belts may be scraped with a putty knife or similar tool having rounded corners. Fibers of a belt, whether leather or some substitute, must never be injured.

To hasten drying the belt may be run through an ordinary washing machine wringer.

Place dry sawdust on the belt, after laying it flat on the floor, and clean with a stiff broom. Then turn the belt over and treat the other side in the same way. After this it is a good plan to pack the belt in powdered chalk, fullers earth, or fine sawdust and keep it in a warm place for a day or so. The warmth will increase capillary attraction and thus aid the packing material in absorbing the oil. After the belt is dry lubricate it with some good dressing recommended by the manufacturer of the belt.

When using gasoline or naphtha to clean a belt, be very careful to avoid fire or explosion. Only a small quantity of gasoline vapor is needed to render the air in a room explosive.

Some types of pulleys also become oil-soaked. An oil-soaked belt on oil-soaked pulleys is a very poor combination for power transmission. Oil can be removed from pulleys as well as belts by a process similar to that described above.

The time to clean a belt is determinable by the amount of slip. As soon as excessive slip occurs there is an unnecessary loss of power and production, which is proportional to the slip. In general, belt slip should be limited to 2 per cent.

Necessity for cleaning belts by soaking in some solvent can be greatly lessened, of course, by improving conditions so that there will be no leakage or splashing of oil on them.

M. M. GOOCH, *Atlantic Highlands, N. J.*

A VOLATILE solvent such as gasoline or naphtha not only dissolves the contained oil, but if allowed sufficient opportunity will in a large meas-

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Answers Wanted

Does Remelting Injure Babbitt?

Rebabbitted bearings are giving us trouble principally because of rapid wear and a tendency to heat up. It has been our practice to melt the babbitt out of old shells and use it in pouring new bearings. Occasionally a little fresh metal is added to make up losses. However, we are wondering whether the repeated melting of the babbitt injuries it in any way; if so, how? Is there any limit to the number of times that babbitt can be used for bearings? What would you suggest that we do to avoid further trouble?—W.B.

Exciters Will Not Operate in Parallel

I should like to know why two of our exciters will not operate in parallel. One is a compound-wound, interpole machine, rated 1,200 r.p.m., 8.5 kw., 125 volts, 68 amp.; the other is also a compound-wound, interpole design, with a rating of 5 kw., 125 volts, 40 amp.

The equalizer bus is connected directly between the exciters and consists of 34 ft. of No. 6 wire. The 8.5-kw. machine is 20 ft. from the d.c. bus, to which it is connected by No. 4 wire. The other exciter is 80 ft. from the bus and is connected to it by No. 6 wire. In both instances the distance from the exciter to the bus represents the actual length of the circuit.

When an attempt is made to parallel these machines the result is a flow of cross current and reversal of the polarity of one or both machines. How can I remedy this trouble? —L.N.

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It's the *bearing* that counts!

Below: Logan bearings on the job. Molds are forwarded to this pouring station direct from molding machines in another bay, via Logan Rolls. Former practice was to pour molds in same bay as molding machines, which tied up machines on account of crane service. Writes the customer, "We find that the output of these machines has increased about 25% since roller conveyors were installed, and crane delays eliminated."

BEARINGS *make* the roller conveyor

● Bearing construction is a paramount factor in any type of roller conveyor. The Logan Dust-Protected Bearing (above) is designed for service where dust or sand, iron filings or similar substances are present. (a) In protected position—set back from end of roll. (b) Revolves as freely as a plain bearing because it has no felt washers. (c) The outer (dust) shield is fixed to the stationary inner race—does not touch any rotating part. (d) In a reasonably dry atmosphere, excellent results are obtained with no lubrication whatever. (e) Hexagon shaft, prevents rotation of shaft and inner bearing race. There is a type of Logan bearing for every roller conveyor requirement. Ask the Logan engineer nearest you, or write for further information to LOGAN CO., Incorporated, 510 Buchanan Street, Louisville, Ky.

Logan Conveyors
LOUISVILLE

ure displace it. That is, if an oily belt is thoroughly soaked in one of these solvents such machine oil as remains in the belt will be in a diluted form, and upon exposure to the air the solvent will evaporate leaving the leather relatively free from oil.

A more thorough job can be done by immersing the belt for several hours in the solvent, and then pressing it tightly between platens. A plywood press or platen press of any kind is the natural tool for the purpose, but almost any press can be fitted with temporary platens of steel or hard wood. The lower platen should be covered with very fine, dry sawdust and a light, even layer of sawdust spread over the belt. Pressure will quickly drive out the solvent mechanically, and with it much of the oil that would otherwise remain in the belt. Both will be immediately absorbed by the dry sawdust, which can afterward be brushed away.

A belt that has been subjected to treatment with gasoline or naphtha requires re-lubrication in the form of neatsfoot oil applied to the back of it with a brush, or a good belt dressing. Otherwise, it will become brash and dry, and its life will be short.

It is usually possible to keep belts from being soaked with oil. When soaking occurs it is a sure sign that oil is getting out of some adjacent bearing and being splashed onto, or wiped off by, the belt. Old-style idler pulleys, which lose their oil by centrifugal force, are one of the greatest offenders in this particular respect.

JOHN E. HYLER, *Peoria, Ill.*

Increasing Speed and Horsepower of D.C. Motor

Is it possible to increase the horsepower output of a d.c. motor by rewinding it so as to increase the speed? For example, we have a 5-hp., 500 r.p.m., 230-volt, compound-wound motor which we want to speed up to 1,500 r.p.m., and raise the horsepower as much as possible. Can the speed of this motor be increased that much? If so, what would be the maximum horsepower that could be obtained?

—H.S.

SPEED and horsepower of a d.c. motor are directly related. On that basis increasing the speed of this motor to 1,500 should, theoretically, increase the horsepower to 15. The increased heating will, however, limit the horsepower to some smaller value. Another limitation will be the amount of current that the commutator and brushes can handle without destructive sparking and heating.

I suggest that H.S. rewind the series fields with 33⅓ per cent of the present number of turns, using wire that has three times the cross-sectional area of the present winding, keeping the same connections.

The shunt winding will remain the same.

Rewind the armature with 33⅓ per cent of the present number of turns with wire having three times the cross-sectional area of the old wire. Use the same connections.

In the event that the machine is four-pole, wave wound, and the commutator risers will not accommodate the new wire, I suggest changing it to a lap winding. Divide the present number of turns by 2 and add 25 per cent, which will give a speed of 1,500 r.p.m. The wire size should be multiplied by 2, plus 25 per cent in cross-sectional area. This wire will be smaller than the wire used in the wave winding; therefore it will be easier to put it in the commutator.

L. C. JONES, *Danville Machine Works Danville, Va.*

IT IS possible to rewind a d.c. motor for an increase in speed and horsepower, within certain limits. Where a change in the cross-section of the armature conductors can be made in proportion to the increase in speed, the capacity of the motor will vary with the speed, and in the same ratio. Thus, if the number of armature conductors in series is decreased by one-half and the cross-section of the conductors is doubled, the speed and horsepower will be doubled. If the conductors in series are decreased to one-third and the

● The standard platform length is 56". Platforms up to 84" can be furnished on order.

ELEVATING TRUCKS

2-TON AND 3-TON CAPACITIES

These two new stream-lined Baker vertical-lift elevating trucks are ideal for use in applications where packaged goods must be handled as there is no possibility of crushing light cartons between the load and the battery compartment when elevating. In foundry core-oven work they will reduce breakage of green cores to the minimum as the legs of the core rack are set down vertically. Their stability, speed, easy operation, greater accessibility and built-in long life will give low cost transportation far beyond the write-off period. Let us show you how and where these trucks in your service can return their cost many times over.

BAKER INDUSTRIAL TRUCK DIVISION
of THE BAKER-RAULANG COMPANY
2178 WEST 25th STREET • CLEVELAND, OHIO

The most economical way to handle material is NOT to HANDle it

Baker

cross-section is increased by three, the speed and horsepower will be increased in the same ratio. Thus the horsepower varies with the change in speed obtained by changing the conductors in series on the armature, and the current will change in the same ratio and in the same direction.

Here enters a factor that may make the proposed change impossible. A careful check must be made of the commutator and brush-holders to determine whether they will carry the increased current without heating or excessive sparking.

In the absence of more detailed information, it is not possible to make any definite recommendations.

If this motor is a four-pole design having a wave winding on the armature it may be reconnected as a lap winding to operate at 1,000 r.p.m. At this speed it will develop upwards of twice the original horsepower, if the 100 per cent increase in current can be successfully handled.

M. V. MILLER, *Indianapolis*

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More Machines, More Jobs

(Continued from editorial page 173)

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installed for drilling and tapping the clutch housing. This new modern machine tool produces this part in sufficient quantity to satisfy the demand, also at a greatly reduced cost. The investment was approximately $7,500.

Another example of what modern machinery can do refers to the machining of the channels of the side plates of the tractor frame. This new equipment represents an investment of approximately $15,000, but out of it we got the required production with greater precision and at a considerable saving of floor space, which was at a premium at this particular spot. Several other machine tools have since been installed in this department, all of which, by careful planning and selection, have proved equally profitable.

The assembly line was originally equipped for 25 tractors per day. We have been adding men and equipment ever since. More and more electric wrenches, air hoists, and similar pieces of equipment have appeared along the line. More men have come in to operate them. The result is, we are assembling 80 tractors a day on the line that once handled 25 a day. The economy, of course, is in better utilization of floor space, which was at a premium.

How has this all worked out, in terms not of the company but of the workmen and also of the consuming public? Well, part of the answer can be given definitely. The rest we must guess at from some pretty basic facts.

As to workers, we are employing a great many more than when we had a daily capacity of 25 tractors. The larger employment is certainly good for Milwaukee's workers. The smaller employment per finished unit, with the resultant greater value, is certainly beneficial to the consuming public. In fact, it is this steady decrease in man-hours per unit of production that has placed our product within reach of enough farmers and manufacturers and contractors so that we have been able to triple this business.

Let's trace it a step further. Tractors are not consumers' goods. They are producers' goods. They are tools of production. They go out into the hands of producers. Farm tractors may be presumed so to lower the production costs of their purchasers that crops that would yield a bare living will now yield enough to send wives and children—yes, and even the farmer himself—to town to buy

INSUROK by RICHARDSON

INSUROK is the superior Phenolic material of a thousand uses, from the tiniest electrical part to heavy-duty bearings and gears.

INSUROK offers an amazing combination of desirable qualities . . . extraordinary strength, toughness, lightness, resilience. For bearings or gears it is a natural shock absorber; reduces friction; wears longer. Used in your own product Insurok adds extra value and usually effects sharp production economies.

INSUROK may be sawed, drilled, turned, punched, tapped, planed, milled or sheared with ease. Available in sheets, rods, tubes, punchings, gear blanks, in grades, sizes and thickness for every application, or may be fabricated to your own specifications in the Richardson plants, the largest in the United States devoted exclusively to Plastics.

INSUROK offers countless opportunities for developing new products, improving old ones, or modernizing your equipment. The Richardson Research Laboratories, Design and Engineering Departments are at your service. Consult us freely without cost or obligation.

The RICHARDSON COMPANY

Melrose Park, Ill. FOUNDED 1858 Cincinnati, Ohio

New Brunswick, N. J. Indianapolis, Ind.

a few articles that without the tractor they could not have afforded to buy.

This added purchasing power in consumption goods fields is certainly a help to our national economy. The contractors who buy our tractors for, say, dirt moving are thus enabled to bid lower than if they had to rely on less efficient tools—which means not only a profit to the contractor but also a lower cost to the purchaser of the building, resulting in some buildings that otherwise might not be contracted for.

That's good for all of us, isn't it? As for the manufacturer who adds one of our tractors in his plant, he may be presumed to do so because it will save him money. And if it saves him something on his costs, does not this once more start the beneficent circle of cost saving that we have already demonstrated in our tractor plant's recent history?

The fact is that new production equipment is a lot more important today than most manufacturers seem to think. I have told about savings in our Milwaukee wheel tractor plant, because it happens to be one of our mass-production factories. I might have told much the same sort of story about our crawler tractor plant at Springfield, Illinois; or our farm machinery plant at La Porte, Indiana; and, less spectacularly but on a smaller scale, proportionately effective, we have been doing the same type of thing in our other plants.

Many of our plants produce special-order equipment that is practically engineered to a particular job; therefore the savings available through repetitive operations on special-purpose tools are not available. It is not, for example, worth our while to install a machine that will knock even 90 per cent off the cost of an operation on a steam turbine if the operation is found only twice on a turbine. We make a lot of turbines, as turbines go, but, as the traditional Irishman said of the ostrich egg, it doesn't take many of them to make a dozen.

Importance of Right Equipment

Any manufacturer who is not at the center of an organization that makes equipment for other manufacturers is likely to underestimate the importance that attaches right now to having the right kind of equipment. We are actually amazed several times a month at the ways in which plants throughout this country and abroad are revising their equipment to cut costs. Through our various lines, we touch almost every industry in the United States, and I think it is a fair assertion that at this very minute there is going through one or another of our manufacturing departments a sizable piece of equipment for every major industry, except only a very few that are almost hopelessly down.

This is materially different from the situation in a great many periods of good business for us, since this widespread distribution of the business discloses that plants everywhere are awake to the opportunity that awaits the manufacturer who gets out ahead of the parade.

After all, there have been several years during which few manufacturers had the volume, the prospects, or the cash to do much equipping. The consequence is that plants are probably more heavily hit by obsolescence than at any other time in American industrial history, not only because of neglect but also because equipment manufacturers have made greater strides in improving their products than ever before in a comparable period.

So we have the exceptional situation of plants that have done a minimum of re-equipping over the years and of new equipment available that is head and shoulders above anything made prior to 1934. This means, of

MEET the lordly crane man! All hands bide their time in getting work from floor to machines as he makes his rounds giving workmen a "lift." He's an autocrat in the machine shop that's not equipped with Zip-Lifts for "spot handling." Not *his* fault—the fault of a system that makes skilled machinists rely upon horse-and-buggy methods of production.

On this broaching machine operation, a ZIP-LIFT doubled production by eliminating crane service delays—"Spot Handled" 6 pieces per hour instead of 3. Total savings amounted to $12.00 every 8-hour shift. Complete installation paid for itself in 40 working days.

The Zip-Lift is the newest development in hoisting equipment, easier to install, *much* easier to buy. Write us today for full details.

HARNISCHFEGER CORPORATION
ESTABLISHED 1884
4525 W. National Avenue, Milwaukee, Wis.

ZIP-LIFT STOPS WASTE WITH "SPOT HANDLING"

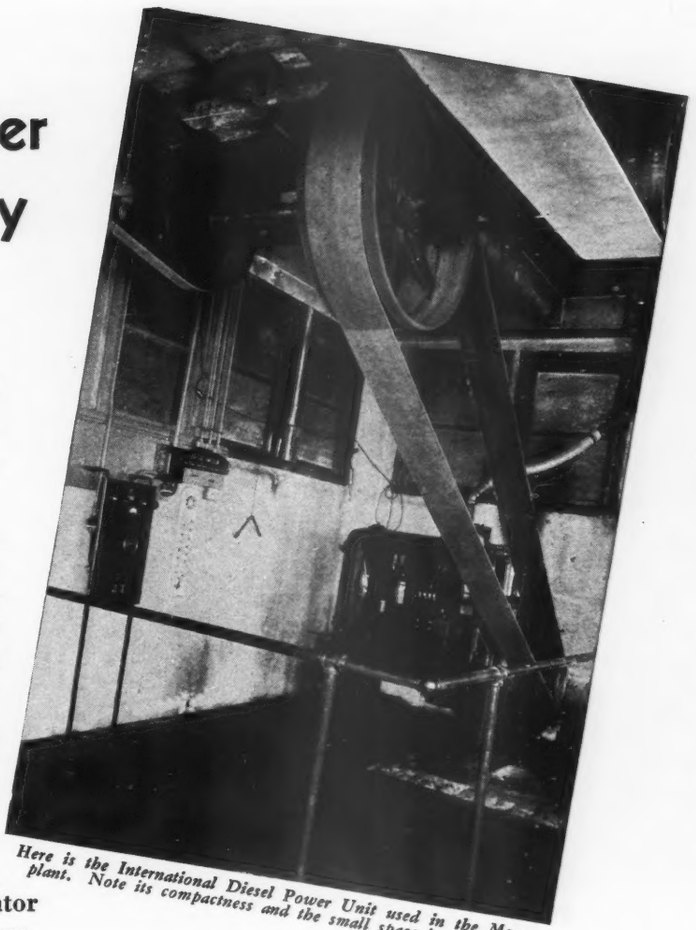
The International *Diesel* Has Cut Power Costs in This Factory to $34 a Month

THE plant of the George W. Moore Co., Boston, Mass., manufacturers of set screws, offers an outstanding example of the savings that can be made by the International Diesel Power Unit.

The average monthly cost of electric power formerly used was $220. The International Diesel is doing the same job for $34, a monthly saving of $186. In the first six months of operation, the International saved more than one-half of its original cost.

"We do not anticipate any appreciable bill of repairs," says George A. Moore, president, "as we purposely selected a Diesel engine that has been tested in severe usage."

All the machines in the Moore factory, numbering more than 50, and a 5 k.w. generator for supplying light, are driven by the International Diesel.

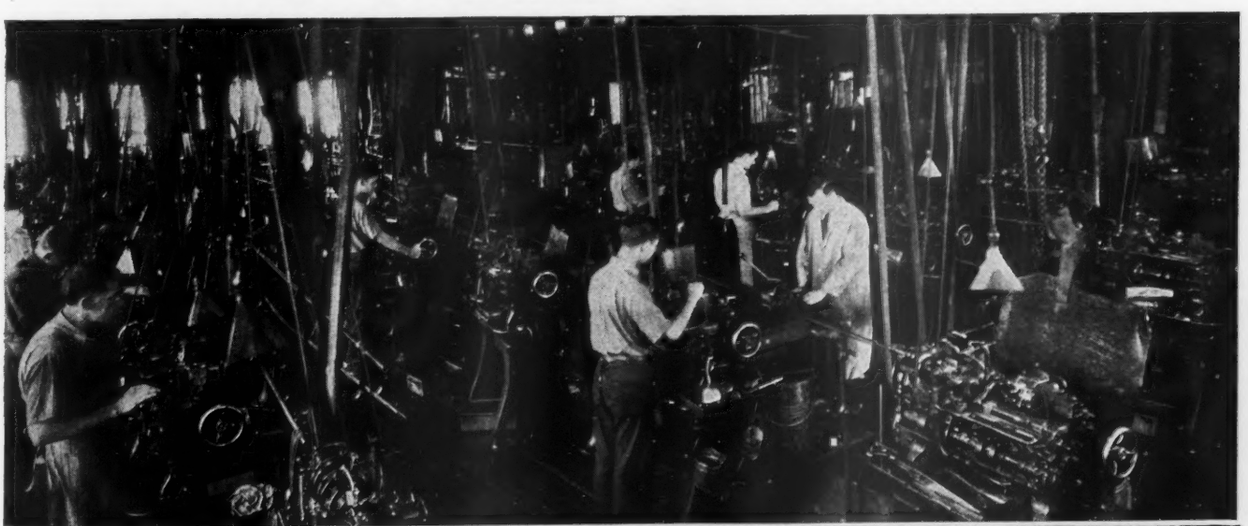


Here is the International Diesel Power Unit used in the Moore plant. Note its compactness and the small space it occupies.

Investigate the International Harvester line of industrial power (gasoline and Diesel) and see what it can do for you. There is a power range from 12 h.p. to 100 h.p. The nearby Company-owned branch or industrial dealer will go into details any time you say.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
606 So. Michigan Ave. Chicago, Illinois

Below: A view of the Moore factory and the Diesel-driven automatic screw machines.



INTERNATIONAL HARVESTER

So writes an official of The Independent Pier Company, Philadelphia, Pa., who continues: "We have in service 50 or more of your Pressed Steel Hand Trucks, some of which were purchased in 1930. Our freight handlers like them so well that they will not use a truck of any other make when an American Hand Truck is available. We have never had the occasion to repair any of your steel trucks although they have been used right along for handling all kinds of heavy loads."

Throughout America hand truck users are standardizing on American Pressed Steel Hand Trucks on a basis of better service and greater savings. There is an "American" for every material handling need. Select *yours* from the American Hand Truck Catalog. Write for it now!

THE AMERICAN PULLEY COMPANY
4200 Wissahickon Avenue, Philadelphia, Pa.

The labor saving, floor saving, rubber-tired, roller-bearing "American" hand truck wheel.

AMERICAN
PRESSED STEEL
HAND TRUCKS

course, that the manufacturer who really gets his plant equipped to turn out its products at the cost level made possible by the newest and best equipment, and does it before all the competing manufacturers whose plants are obsolete, is likely to get so far ahead of competition that the rest can never hope to catch up.

How About the Public?

But throughout this article we have been attempting to keep a slightly broader outlook than the individual manufacturer's welfare and profits. How about the effect on the general public? It seems pretty nearly obvious that if the manufacturer turns out better goods at a lower proportionate price, he makes these goods available to more people than before. Therefore, as with our tractor experience, he sells more of them. He gives more workers employment though doubtless putting fewer man-hours into each unit of product. As for his competitors, they will quickly have to do the same thing or lose out because they have become too inefficient proportionately to deserve public support.

It all comes down, of course, to that most basic of economic facts, that wealth is not money. It is goods. The more goods that are turned out and distributed to the general public, the higher our scale of living and the better off our people, which is, after our own immediate responsibility of looking after our individual families, what we all really want.

•

Factory Paper in One-Tenth the Time

(Continued from editorial page 176)

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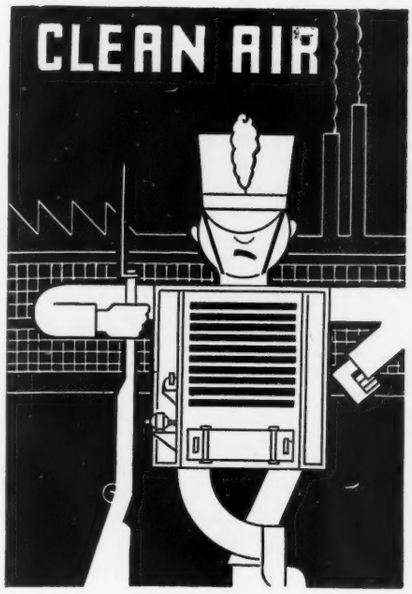
When an employee starts a new job he reports to the clerk's desk where a time ticket is imprinted with his name, order number, and description of the job. He is given a plain 3x5 card imprinted by the same descriptive plate used for the labor ticket. This card is his means of communication with the clerk until he has completed his work, thereby eliminating the ever-recurring transposition of order number that exists when employees report verbally. The starting time is registered by the time clock, and the ticket kept on file at the clerk's desk. At completion of job the workman reports with his card. His labor ticket is then punched out on



Guards YOUR PRODUCT'S MARKET VALUE

With air purified by a Coppus Air Filter (proved by dust-count of filtered air, to deliver cleanest air of all commercial filters)—the quality of your product is maintained 100%. In many industries—food, drugs, chemicals, films, etc.—freedom from contamination, discoloration, and foreign matter is essential. Coppus air filtration gives a sales plus to your product, an added assurance to the buyer. Cost is comparatively slight—returns in confidence and expanding your market are great.

Other profitable features include SIZEABLE PRODUCT RECOVERY from the air; PREVENTION of dust-caused OCCUPATIONAL DISEASES; PROTECTION OF MACHINERY from dust-caused wear.

Write for Bulletins F-320-3 (unit type filters) and F-350-1 (on DRY-MATICS, *the only self-cleaning dry filters made).*

COPPUS AIR FILTERS
PASS *Clean* AIR

COPPUS ENGINEERING CORPORATION

375 Park Ave., Worcester, Mass.

Sales Offices and Distributors listed in THOMAS' REGISTER

IN SWEET'S also BLOWERS AIR FILTERS HEAT KILLERS STEAM TURBINES

8320

the time clock. The only pencil work needed on the work ticket is total elapsed time.

The embossing of plates for a special job has proved of great value in issuing labor tickets and eliminating the need for checking. The plates more than pay for themselves in time saved. Some of these plates, such as those for orders for dies and tools, are used over and over again, while others may be used only for the one job.

Advantages

Production control methods used at the Addressograph - Multigraph Corporation have the following distinct advantages:

1. All materials and parts are centrally controlled; plates are embossed only in the main factory office, and no changes can be made on them outside this office.

2. No bills of material or time cards with pencil or pen changes on them are acceptable unless O.K.'d by the head of the production office.

3. No inventory shortage problem arising from changes being made in bills of material by foremen and not reported to the production office.

4. Less chance for error.

5. Faster handling of name and data writing requirements.

6. Flexibility in handling changes in production method.

•

Slim Pickings for Shylocks

(Continued from editorial page 188)

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Fund account, which can only be used for losses in case of bad loans. This Guarantee Fund amounts to 20 per cent of yearly gross earnings, and is provided for in the bylaws.

Membership is open to all Cutler-Hammer employees and their families. Shares are $5 each, and 100 shares, or $500, is the most any one member can hold. A minimum of one share is required of a member before being eligible to make application for a loan.

Loans up to $50 need no security other than the borrower's signature. Further security is required of the borrower on loans over $50—a co-signer, assignment of wages, or other acceptable collateral. The credit union does not depend upon payroll deduction. We have always felt that payments should be individual and handled the same as though made at

*Elephant power, meaning big horsepower, as in large turbines.

E.P. is what you pay for when you use large-sized steam turbines for small-sized jobs.

The Coppus line—alone in offering you 6 sizes from 150 H.P. down—lets you match the turbine to the small job. So you pay only for the H.P. you need.

The result is a saving in original investment and in power consumption.

No other quality steam turbine is as inexpensive as the Coppus.

SAVINGS ON LOW SPEED RUNS

While a turbine is most efficiently operated at high speeds, a Coppus can run profitably at low speeds, too, since it can be equipped with built-in speed reducer. (No other complete line of small steam turbines offers this feature.) No accessories or installations to pay for.

STEAM TURBINES MEAN

1. Cheaper power.
2. No sparking—safe in explosive atmosphere.
3. No burning out with overloads—wide speed range.

Write for Bulletin 135-8.

LARGE PROFITS COPPUS STEAM TURBINES FROM SMALL PACKAGES

COPPUS ENGINEERING CORPORATION

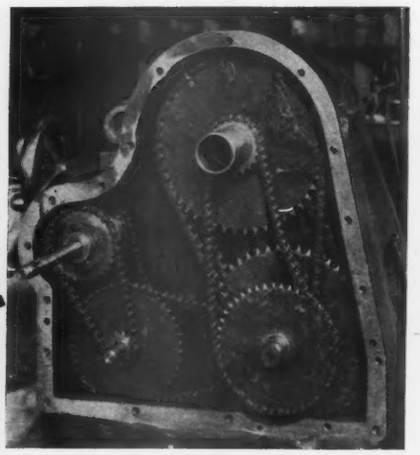
375 Park Ave., Worcester, Mass.

Sales Offices and Distributors listed in THOMAS' REGISTER

IN SWEET'S also BLOWERS AIR FILTERS HEAT KILLERS STEAM TURBINES

8321

ROLLER CHAIN is Quieter-Less Expensive HERE



There are seven ½" pitch chains in this brake-drum lathe headstock.

Hardened steel sprockets and precision machined roller chain—both of Baldwin-Duckworth manufacture, replaced a chain of gears in this brake-drum lathe headstock.

The manufacturer saved money because the cost was less.

The owner was pleased because the lathe was quieter and easier to service. He benefited from the cost saving, too.

Today, almost any conveying or power transmission job can be done economically with roller chain. Get acquainted with the Baldwin-Duckworth engineer in your territory.

BALDWIN - DUCKWORTH CHAIN CORPORATION, Springfield, Mass.

BALDWIN-DUCKWORTH

"The oldest and surest protection against power plant grief"

"Saving pennies and risking dollars using other, uncertain and *non*-uniform graphites, just doesn't make sense."

For Cylinders, Bearings, Gaskets and Threaded Joints. Used as a co-lubricant in miscellaneous manufacturing operations.

AT SUPPLY HOUSES *EVERYWHERE*

Write for Circular C-44

JOSEPH DIXON CRUCIBLE COMPANY
Jersey City, New Jersey

DIXON'S TICONDEROGA LUBRICATING FLAKE GRAPHITE

WHAT A SLICK LITTLE GADGET THIS IS
DIXON'S GRAPH-AIR GUN
AND WHAT A HELP THESE ARE
INSOLUBLE IN WATER
INSOLUBLE IN OIL
DIXON'S Belt Dressing
SEND FOR CIRCULARS

6541

a bank. This applies to both loan payments and shares deposits.

The Cutler-Hammer credit union has helped employees save many thousands of dollars by enabling them to pay cash for purchases, taxes, and other bills. It has been our policy not to loan money for any but provident purposes, and it is to this that we give much credit for our success. We do not loan money for real estate mortgages, because the credit union is not set up to make the necessary examinations of real estate titles and abstracts.

Many of our members joined in order to save money for Christmas. To meet this situation, the board of directors made the dividend payable on December 15, as of December 31, thereby enabling anyone to withdraw his money any time after the fifteenth without losing the dividend.

In Strict Confidence

During the past two years the credit committee has turned down about fifteen applications for loans, in some cases because the money was not intended for provident purposes, and in others because the borrower had not been sincere about making payments on previous loans when in a position to do so. All loans are kept in strictest confidence, records being kept by book number rather than by name, and are even known only by number when referred to in the board meetings or recorded in the minutes of the board.

After three years of operation, during which time we have enrolled 50 per cent of the employees, we have been backed by a steadily increasing feeling of confidence, emanating from employees who find themselves realizing the advantages of a cooperative undertaking in which they are able to avail themselves of the benefits of small, easily made loans. From the human relations standpoint, it has been one of our most successful plant projects.

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New Instruments for Industry

(Continued from editorial page 192)

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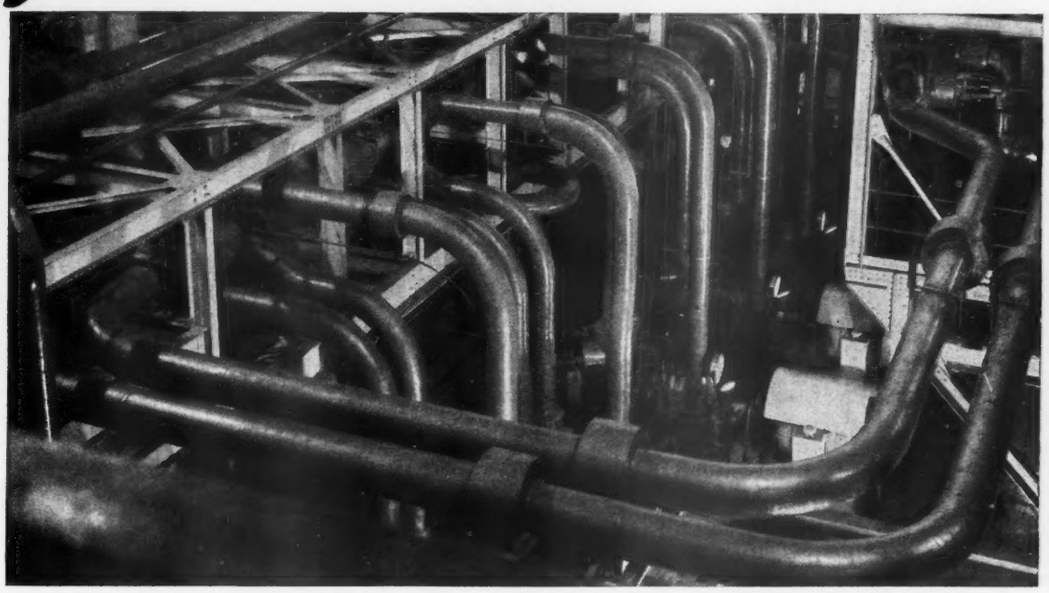
thickness of the enamel. Since the amount of flux controls the current in the instrument, the pointer shows the thickness of the enamel or other non-magnetic material between the gage head and the magnetic sheet with which it has been calibrated.

Of less direct use to the shop than to the engineer whose design is

Consider FABRICATED PIPING



● Crane High-Pressure Fabricated Piping in Boiler-Feed Lines.

THE elasticity and low internal friction of Crane fabricated piping warrants its thorough consideration when modernizing existing power plants or planning new ones. The elasticity of relatively large radius bends relieves the stresses that accompany expansion and contraction. The scientifically designed turns reduce internal friction and thus contribute to a higher efficiency for the pipe layout as a whole.

Crane special machinery and apparatus bends even the heaviest piping to the exact degree specified and then threads, bevels, flanges or Cranelaps to precise measurements. As a result, you can count on the bend going in place as you planned it, with no undue strains on the piping, fittings or valves. Uniformity in the wall thickness and in cross section, regardless of the pipe's weight or diameter, is assured. These are advantages in having your pipe fabrication done by a manufacturer of quality valves and fittings. He knows that precision is of paramount importance in piping installation and accordingly has the machinery and skilled artisans necessary to obtain it.

Place the entire responsibility for your pipe bends, valves and fittings with a single source of supply—Crane. There you are assured of the piping assembly best suited to your purposes. There's a Crane branch or distributor in your city who will be glad to work with you on any piping problem.

CRANE PIPE FABRICATION

1 A COMPLETE PIPE-BENDING SERVICE FROM FORMING SMALL PIPE FOR VARIOUS SERVICES TO BENDING HIGH-PRESSURE PIPING TO ANY DESIRED SHAPE.

2 EVERY BEND FITS EXACTLY INTO PLACE. SPECIALLY DESIGNED CRANE MACHINERY ASSURES THIS.

3 CONNECTING ENDS THREADED, BEVELED FOR WELDING, FLANGED AND REFACED, OR CRANELAPPED.

4 CRANE ELIMINATES WASTEFUL, INCONVENIENT DIVISIONS OF RESPONSIBILITY BY CENTERING PIPE FABRICATION IN ONE ORGANIZATION WHICH ALSO MANUFACTURES VALVES AND FITTINGS.

Let Profits Pay for Plant Improvements. Use the Crane Finance Plan.

CRANE

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVE., CHICAGO, ILL. • NEW YORK: 23 W. 44TH STREET

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

Air-hardening steel of the high-chrome, high-carbon type develops desired hardness, strength and toughness at comparatively low temperature when hardened by the Triple-Control Hump Method. Here's an example from our own heat-treat.

HOW TOOL-UP COSTS ARE CUT IN THE L&N PLANT

Compactness, cleanliness and easy accessibility are features of this arrangement of two Triple-Control Hump equipments in the L&N Heat-treat.

Tooling-up in the L&N plant requires punches, dies, lathe tools, etc., for a remarkable variety of materials. Nickel, monel and stainless are worked, as well as aluminum, rubber, and bakelite. Our various products—precision instruments; Metermax combustion controllers; Micromax pyrometers; indicators; recorders and controllers for a wide range of quantities; Homo and Hump Furnaces—keep our tool-designers busy finding better tools and tool steels.

The tool-designer's task is simplified because, as far as the heat-treat is concerned, he can use any steel. He selects alloy, straight carbon or cold-rolled as indicated by cost, ease of working and desired production. He thinks of the work that the tool must do—not of the heat-treat it can stand.

The reason for freedom in selecting tool steels is that the heat-treat uses the Triple-Control Hump Method furnace for hardening all tools. The Hump Furnace takes in its stride all steels that harden at 1850 F or less. There's no packing, either to keep carbon in high-chromium, high-carbon tools or to put it into ones that require carburization. There is no distortion. And, as has always been the case with the Hump Method, every tool is a producer, and average tool life is extremely high.

These advantages can be enjoyed by any tool-making, tool-using concern. Let us supply further facts.

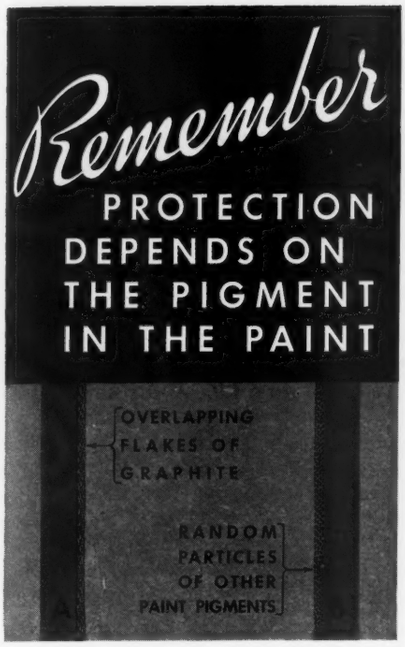
LEEDS & NORTHRUP COMPANY
4909 STENTON AVENUE PHILADELPHIA, PA.

LEEDS & NORTHRUP

Homo Tempering Furnaces
Homo Nitriding Furnaces
Triple-Control Hump Hardening Furnaces
Ho-Hump Multi-Purpose Furnaces

Micromax Controlling, Recording & Indicating Pyrometers
Thermotube Pyrometers
Optical Pyrometers
Precision Instruments

J-621A(4a)


Remember
PROTECTION DEPENDS ON THE PIGMENT IN THE PAINT
OVERLAPPING FLAKES OF GRAPHITE
RANDOM PARTICLES OF OTHER PAINT PIGMENTS

Remember, too, that graphite is the only chemically inert paint pigment that consists of microscopic flakes which overlap each other on the painted surface. No other paint pigment provides the overlapping flake protection of graphite. No other pigment provides equal protection. In addition, graphite adheres tenaciously, is inherently moisture-repellent and stable.

That is why Dixon's Industrial Paints — natural flake silica-graphite in pure, boiled linseed oil — protect for years and years after other paints have yielded to moisture, heat, fumes, abrasion and other deteriorating influences.

For the lowest cost per square-foot-year, for the ultimate in paint protection and painting economy, paint with Dixon's Industrial Silica Graphite Paints. There are fourteen colors, including aluminum. Master Specification BI 44 gives complete data. Write for a copy.

Paint Sales Division

JOSEPH DIXON CRUCIBLE CO.

Established 1827 — Jersey City, N. J.

DIXON'S INDUSTRIAL SILICA-GRAPHITE PAINT

transformed into the finished product in the shop are the devices from which the electric gages have been evolved. They include electric gage heads together with associated means for measuring stresses in machine parts, in structural members such as bridges, in locomotive parts and in rails, pressures in hydraulic lines, pressures developed in explosions, and other similar applications.

These units are used with an oscillograph to give a record, with the time, of the phenomena being studied. As an example of what may be accomplished with these gages, deflections of parts may be measured on, say, a locomotive over a 100-mile run, $\frac{1}{10}$ in. of record being equivalent to one rail length. The cost of obtaining such measurements is high, but the value of the results is commensurate with it.

Measuring Color

Electrical measurement of color is one of the latest realities made available to the shop. It has not yet been reduced to as simple a measurement as it must eventually be. The demand from industry today is for a small "eye" that can be directed to a part and have a scientific value of the color of the part appear simply and instantly. To date, there is no such instrument. The reason is that what happens physically when light is reflected from a part to the human eye, to give an impression of what we call color, is so complicated that simple instruments have not yet been devised to completely evaluate the process.

Although complicated, the instruments that have been devised to give a scientific value of color, are superhuman in their results. The recording photoelectric spectrophotometer analyzes the color of a material by producing a curve to show the reflectance or transmission of light over the entire visible spectrum. This permits a scientific value of color to be given to coloring materials, thus offering a means of control of materials and processes. Such a control will make it possible to turn out parts or products differing so little in color that complete interchangeability is possible.

In the manufacture of paints and pigments, fabrics, glasses and lenses, and in other industries where color is of prime importance, the recording spectrophotometer is providing results whose usefulness fully justifies their cost.

Where the color measurement requirements are more simple physically, simpler instruments can be used. For example, a reflection

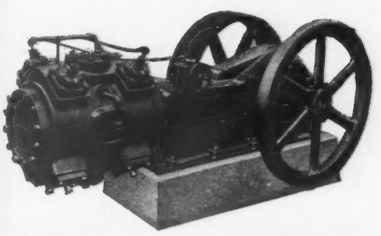
Keep your air-operated equipment

ON THE JOB

with

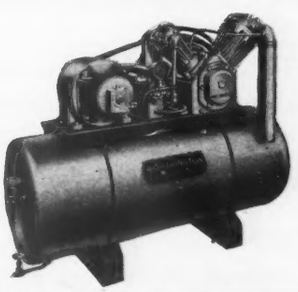
WORTHINGTON COMPRESSORS

THEY are serving hundreds of plants... where maintained low-cost operation and an uninterrupted day-in and day-out compressed air supply are prime requisites for economical production.



SINGLE-STAGE UNIT FOR BELT DRIVE

Also available with steam and direct-connected motor drive... for capacities to 1985 cu. ft. per minute and pressures to 150 lb. per sq. in.



ANGLE TYPE TANK-MOUNTED UNIT

One of numerous arrangements for small compressed air requirements... with gasoline engine or motor drive... for capacities to 82 cu. ft. per minute and pressures to 200 lb. per sq. in.

There is a Worthington unit to meet *exactly* every compressed air requirement

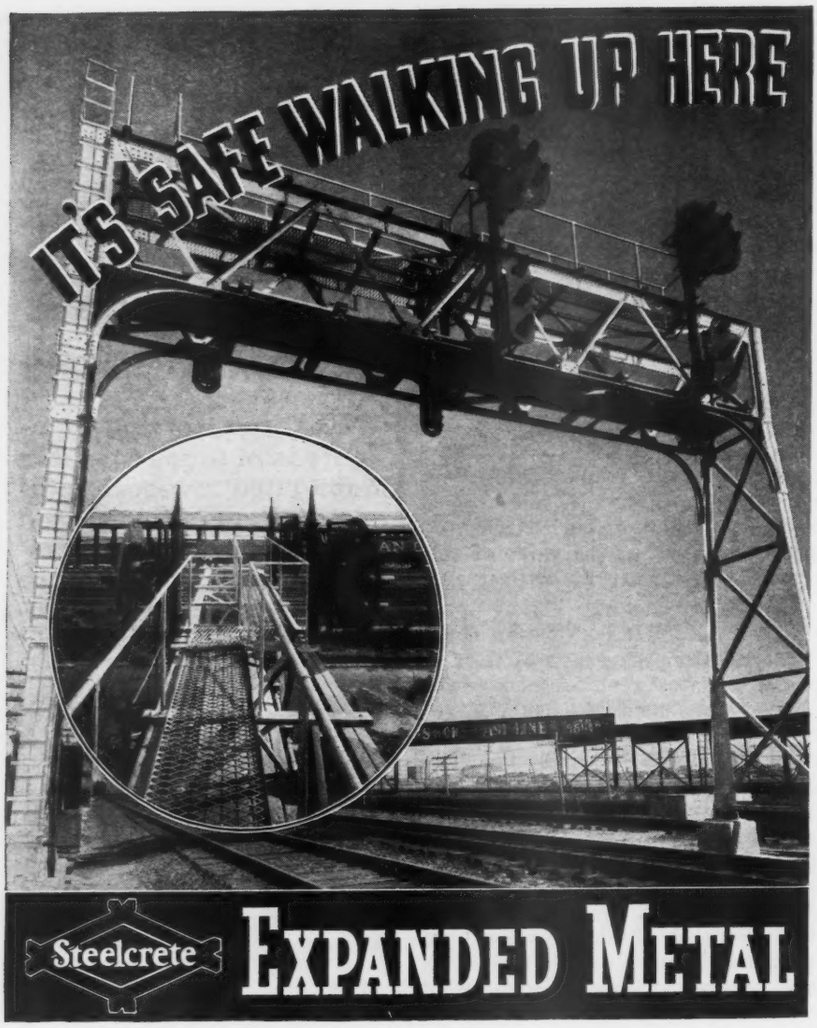
● ***Write for bulletins***

WORTHINGTON PUMP AND MACHINERY CORPORATION

General Offices: HARRISON, NEW JERSEY

Offices and Dealers in Principal Cities

WORTHINGTON



Steelcrete EXPANDED METAL

The Steelcrete brand of Expanded Metal for skywalks is insurance against accidents. It is a strong non-skid fabric, the strongest type of open mesh. It is self-cleaning and does not obstruct light. Metal is expanded from ¼-inch steel plate and diamond openings are approximately 2 x 6 inches in size. Finished skywalks, walks adjoining crane runways, around tanks and boilers, are easily constructed and are economical, requiring little or no maintenance expense. Estimates furnished promptly covering all materials required including angle supports, railings, etc. Expanded Metal fabric supplied ready to install in 16¼, 24¼ and 48¼ inch widths, plain, painted or hot dipped galvanized.

New Expanded Metal Fence

This company now offers the new Expanded Metal Fence for industrial purposes, employing flat sheets of galvanized expanded metal and all necessary galvanized accessories for the complete protective fence installation. New in principle and advantages, economical.

Write for descriptive booklet

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses: New York Chicago Cleveland Pittsburgh Philadelphia Boston Buffalo Houston Atlanta
Export Office: 330 West 42nd St., New York, N. Y.

meter of relatively simple construction controls the color of certain grades of paper. Hence, the cost is lower and the operation simple enough to make it a shop tool. Suitable measuring equipment for uniform and satisfactory color control can be had for other applications.

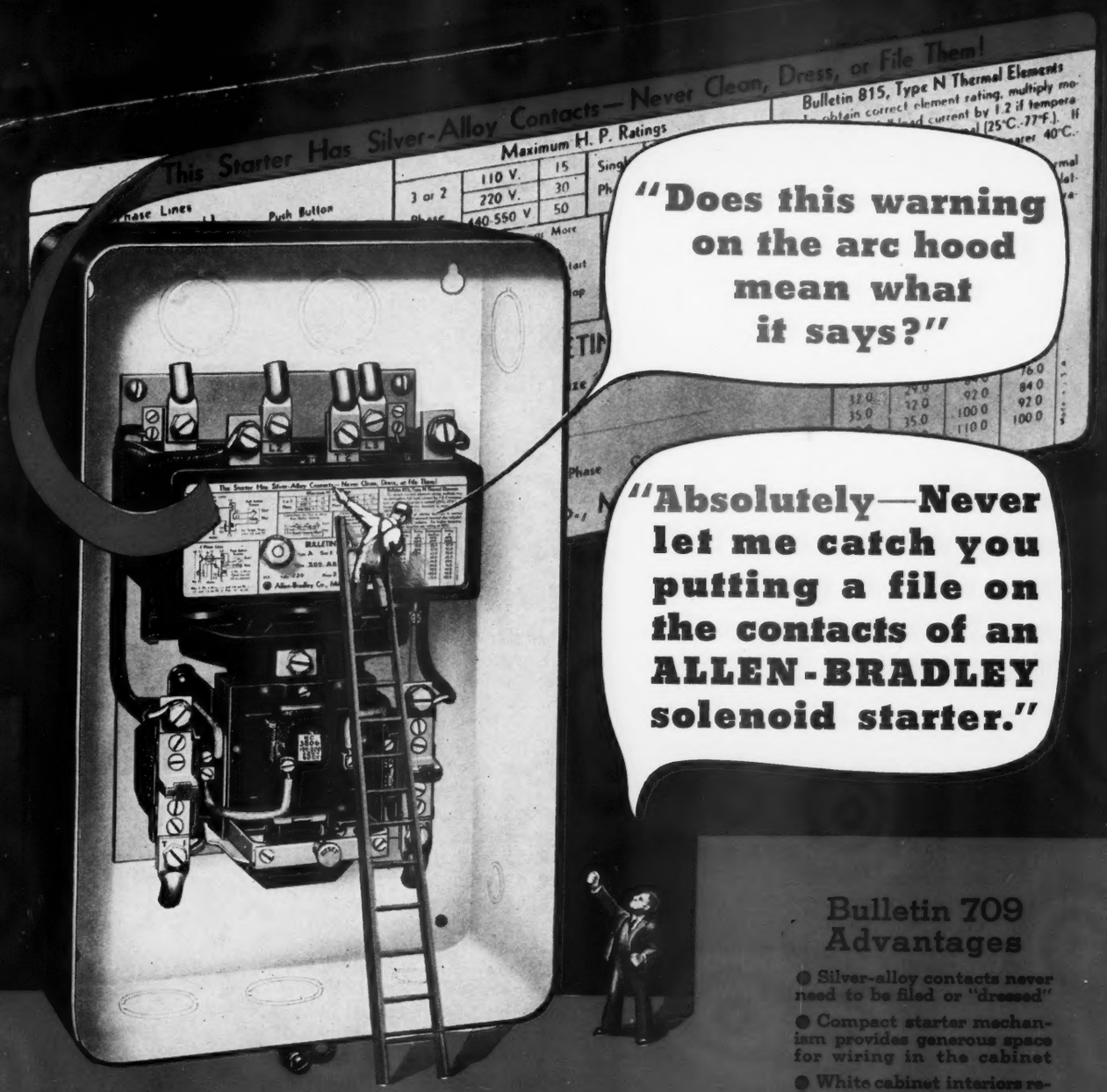
And Sound

Shop measurement of sound is in about the same category as the shop measurement of color. What is desired by industry today is an "ear" that can be directed to the sound coming from a mechanism and cause a scientific value of the sound to appear simply, instantly, and reliably. To date there is no general, all-purpose instrument of this kind available. The reason for this is the same as was given under the measurement of color. What happens physically when sound waves produced by a mechanism strike the ear to give an impression of what we call sound, pleasing or displeasing, is so complicated that simple instruments have not yet been devised to evaluate the process with exactness.

Instruments that have been devised to give a scientific value of sound are, nevertheless, serving a useful purpose in the hands of trained users by aiding in the design and adoption of noise-reducing means to give quiet performance of equipment. An available sound-level meter and analyzer uses a microphone to pick up the sound, an "ear-weighing" network to evaluate it, and an analyzer to determine the frequencies present, whether low or high, and in what degree.

For the study of noise, a soundproof room is essential. With the necessary sound measuring equipment it will permit design studies to be properly made. When these measurements or standards are transferred to the factory for noise control of the product, a noise booth equipped with measuring devices is likewise essential. The size and construction of the booth should be appropriate to the product. The shop booth shown is for noise control of electric motors in production. This is truly a shop application, restricted to a particular product. Any application should be studied in order to provide suitable means for maintaining the desired limits in a product.

In order that sound measurements may be more useful they have been the subject of much standardization work by physicists and engineers working together, and recent standards issued by the American Standards Association go a long way to-


This Starter Has Silver-Alloy Contacts—Never Clean, Dress, or File Them!
Maximum H. P. Ratings
"Does this warning on the arc hood mean what it says?"
"Absolutely—Never let me catch you putting a file on the contacts of an ALLEN-BRADLEY solenoid starter."

Put away your files and sandpaper! They cannot help the contacts of the Bulletin 709 solenoid starter—they only harm them. The only maintenance these starters require is an occasional inspection. Any oxides that may form on their silver-alloy contacts will not interfere with their operation. Furthermore, as contact life is not filed away, contacts last many times as long as ordinary copper-to-copper contacts.

Bulletin 709 starters make neat, attractive installations. Their low drop-out voltage prevents unnecessary shut-downs when line conditions are bad. Currents often times their maximum horsepower rating can be safely handled.

Bulletin 709 starters are available in three sizes for motors up to 30 hp, 220 v; 50 hp, 440-550 v.

Send for the latest descriptive literature on the Bulletin 709.

Allen-Bradley Company, 1321 S. First Street, Milwaukee, Wisconsin

Bulletin 709 Advantages

- Silver-alloy contacts never need to be filed or "dressed"
- Compact starter mechanism provides generous space for wiring in the cabinet
- White cabinet interiors reflect light and give better illumination in dark places
- All wiring connections are visible and accessible from the front of starter cabinet
- Knockouts are provided on all sides and back of cabinet
- Cabinet cover is completely removable, permitting easy access to starter mechanism

ALLEN-BRADLEY

BULLETIN 709 SOLENOID STARTERS

He socks 'em a mile
BUT HE THREE-PUTTS EVERY GREEN

BE SURE YOUR FIRE EXTINGUISHER HAS NONE . . .

THERE'S no competition like industry. Second-raters don't fit in . . . especially fire extinguishers that can't do a *complete* job.

Can the extinguishers in your plant come through in emergencies? Can they handle paint or gasoline blazes? Short-circuited electrical equipment fires? Do they leave a mess, create dangerous fumes?

The safe answer to all these questions lies in one and only one extinguisher — LUX. Safety engineers rely on LUX to kill all kinds of fires . . . *snuff them out* with a fire-killing blizzard of carbon dioxide snow. LUX is clean, dry and harmless to man or materials. It leaves no mess, no gas. Yet it is the fastest known extinguishing agent.

Fire extinguishers that do their jobs as efficiently as LUX have a definite place in thousands of industrial plants. A new booklet describes the value of LUX to you. Write for your copy of "Instant Death to Any Fire."

LUX SNUFFS OUT FIRE

Walter Kidde & Company
52 West Street, Bloomfield, N. J.

For All Electrical and Flammable Liquid Fires

wards providing specifications for instruments and methods that will give the same results under the same conditions of mesurement. Sound-level meters should, therefore, conform to ASA Standards both electrically and acoustically in order to provide comparative readings.

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Standard Costs for Profit Control

(Continued from editorial page 187)

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article cost is then determined by finding the amount of direct labor contained in the cost of the article and applying the burden percentage determined as above.

Scrap Costs

The foregoing estimates of labor, material, and overhead costs should represent the value of the net amount of material which gets into the finished product without any allowance having been made for waste. In practically every manufacturing industry, waste of one kind or another occurs during the process of manufacture, and material is lost. It will be obvious that if loss of material occurs through trimming, spoilage, etc., after work has been done on it, the loss involves not only the actual material, but labor and overhead of the preceding operations as well. These losses must all be carefully determined and included in the standard loss allowance. Furthermore, the standard loss allowance should not necessarily be the actual current loss but should rather be based on good operating experience or desired performance.

Final step is the compilation of standard product costs by combining the standard material, labor, burden, and scrap costs from the tabulations of basic data. If they have been properly compiled, this work is elementary routine.

The completed standard cost represents an attempt to predict what the cost should be under standardized conditions. In actual practice, however, conditions are never exactly as they were estimated and as a result actual costs may vary appreciably from the standard. Consequently the standards are useless for many purposes until converted into current actual costs.

Determination of Current Actual Costs

Differences between total standard costs and actual expenditures during a period are known as "cost variations" and are usually expressed in

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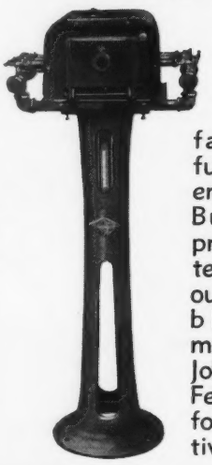

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dollars, giving each element of cost its proper perspective. The relationship of actual to standard, expressed as a percentage, is known as the "ratio," and besides giving a measure of efficiency, provides a convenient means of adjusting standard article costs to current actual costs.

Variations and ratios are determined weekly, monthly, or for any desirable period by finding the standard value of all work performed and comparing it with the actual cost of doing the same work. The ratios for labor, material, burden, and scrap determined individually in this manner are applied to the respective elements in the standard article cost, the result being the approximate current actual cost.

Assume the following:

Actual labor for a period	$3,300
Standard labor for the same period	3,000
Variation	$300

$$\text{Ratio } \frac{3{,}300}{3{,}000} = 1.10$$

Suppose the standard labor cost of an article had been $0.10 per piece, then the actual cost during this period was $0.10 × 1.10 = $0.11.

This method of applying ratios provides a comparatively simple means of estimating actual costs in advance of actual manufacture. Provided the necessary operations can be predetermined and the standard time estimated from tabulated data on file, the standard cost can be built up. By applying to this the current cost ratios, a fairly accurate estimate can be made of the current actual cost.

(A concluding installment — scheduled for June publication — discusses accounting to secure cost variations and ratios, profit variations, value of standard cost methods.—Ed.)

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So Your Walls Leak!

(Continued from editorial page 190)

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channel out of the angle iron and thus compel any water reaching this lintel from above to drain off the ends of the channel into the untreated brickwork and aggravate leakage around the window reveals. The proper treatment is to cut the brick or mortar at the reveal lines with a narrow chisel, expose the upright leg of the angle iron, and form a dam of calking compound. The

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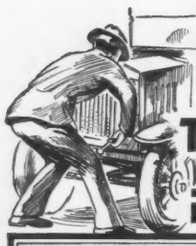
300	Clear	90c	75c
500	Clear	$1.55	$1.40
150	Clear Daylight	65c	50c
200	Clear Daylight	90c	80c
300	Clear Daylight	$1.35	$1.20
500	Clear Daylight	$2.30	$2.15



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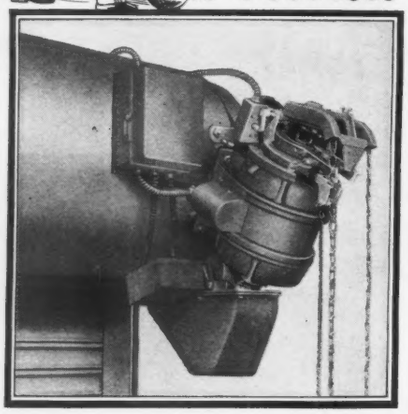

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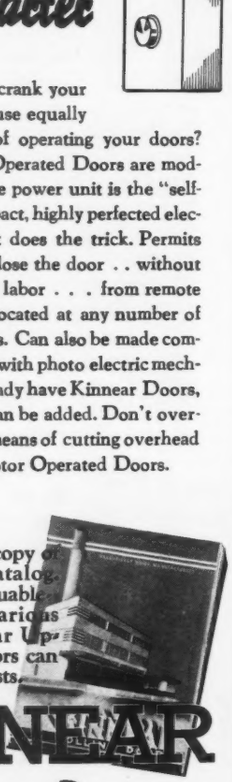

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lintel dams assure the functioning of the angle iron as a dump out.

Pointing and calking alone will not always cure a leaking wall. If a rubber raincoat were draped over it, a brick wall would still have water in it at times; hence the waterproofing problem becomes one of reducing the amount of moisture a wall must handle to the point where no interior damage occurs.

Since remedial waterproofing can be done only on the surface of the brickwork, transparent damp-proofing is a sound investment. Cracks at the surface can be closed up by pointing, but many cracks continue through the wall; if porous brick is permitted to bleed water to a crack behind the pointing, capillarity may quickly draw water laterally through the crack.

What Tests Showed

The Bureau of Standards has conducted tests of transparent damp-proofings on various single units of masonry, and the results indicate that hot paraffin is the most efficient of those tested. This method is, however, relatively expensive and darkens the masonry to a marked degree.

Of materials that are applied cold, those containing paraffin and china wood oil (with about 30 per cent total solids in the solution) are highly recommended. Tests show 100 per cent efficiency at the end of eight years, and nearly 90 per cent efficiency at the end of thirteen years. These solutions likewise darken the masonry, but the drying of the china wood oil tends to seal in the paraffin, so that there is less tendency to gather dirt on the surface than when paraffin alone is used.

These transparent damp-proofing solutions do not produce a continuous film on the brickwork, but form a water-repellent pore coating. Hence their efficiency depends upon the pore size of the masonry and the surface tension of the solid materials contained in the solution. Simple laboratory tests show that there is a critical pressure for each material at each pore size; if this critical pressure is exceeded, water enters rapidly through a nicely lubricated orifice. For this reason it is a fallacy to stipulate that a satisfactory job must withstand leakage against fire-hose water pressure. This pressure usually exceeds the critical pressure of the transparent damp-proofing, and is far more than that encountered in most storms.

Application of a transparent damp-proofing material will prevent the absorption of water by the mortar joints, reduce the movement pro-

MOTORS THAT CAN'T TAKE

OVERLOADS

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